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A National Environmental/Energy Workforce Assessment. Missouri

National Field Research Center, Inc, Iowa City, Iowa

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A National Environmental/Energy Workforce Assessment

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16. ABSTRACT

This study is one of 70 volumes assessing the workforce needs (manpower needs) for pollution control and abatement in the United States for the five-year period of 1976 through 1981. Seven fields for pollution control — air, noise, pesticides, potable water, radiation, solid waste, and wastewater — are analyzed, together with energy-related programs currently accentuated by the national effort to solve energy supply problems.

Designed as Phase I of a three-phase program, the complete assessment includes the following volumes: one each for the 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands; one for each of the ten EPA regions; a one-volume National Abstract; a volume on National Legislation; a volume on Business and Industry; and a four-volume National Summary. The information was gathered through extensive personal interviews with responsible federal, state, and local officials in every state; with officials of representative private industrial and commercial firms; and with representatives of national industrial and trade organizations.

Phase II will develop a broad national inventory of the entire range of post-secondary and higher education training offered in the pollution control and energy areas cited above, and Phase III will offer demonstrations for curriculum changes or modifications which appear necessary to assure an adequate and properly trained national environmental/energy workforce.

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WORKFORCE ASSESSMENT

for

MISSOURI

Conducted by:

NATIONAL FIELD RESEARCH CENTER, INC

Under Grant from:

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PREFACE

This study presents an analysis of existing workforce levels, training programs, and career potentials and develops five-year staffing level projections (1976 to 1982) based on available information for the State of Missouri in the environmental pollution control areas of air, noise, pesticides, potable water, radiation, solid waste, wastewater, and energy. This report is one portion of a study of the fifty states, Puerto Rico, and the Virgin Islands that was conducted by National Field Research Center, Inc., of Iowa City, Iowa.

The data presented in this report were compiled through comprehensive on-site interviews with professionals working in the public and private sectors. Supplementing this method were telephone surveys, mail contact, program plans, and research of relevant literature. It should be pointed out that the data, where not documented by records, represent the best professional judgment of these experts.

FOREWORD

Information for this report was largely compiled from on-site interviews with professionals within Missouri's state agencies with environmental protection functions and with professionals engaged in pollution control activities in the private sector. To strive for a higher degree of reliability, interviews were supplemented with telephone research. It should be noted that a large portion of the information contained herein represents the best professional judgments of those persons surveyed. The term "sources in the field" is used in this report to denote the pollution control professionals who provided information for the project. In cases in which more than one person provided input into a single program area, compilation of figures and recommendations was provided by the author. Much of the background material on agency programs, functions, and activities was obtained from program plans of the appropriate agencies.

This report provides information on the following eight pollution control fields: air, noise, pesticides, potable water, radiation, solid waste, and wastewater. In Section C of each chapter entitled, Workforce Projections, average per annum growth/decline rates are derived by first calculating each year's growth rate for each category. The sum of these figures under each category is then found and is divided by the total number of years, i.e., by five.

Within the agencies and industries that were researched, compartmentalization of employees into the eight pollution control areas is not

necessarily a clearcut situation. Functions occasionally overlap, inter-divisional cooperation occurs, and certain components serve a supporting role to an entire agency. Efforts were made in the preparation of this report to provide sufficient information for the reader to have an understanding of those segments of the workforce that play a major role in environmental protection activities and to provide divisions in a logical, realistic, and understandable manner.

National Environmental Energy
Workforce Assessment

Phase I

MISSOURI

State Summary

I. AIR

The Missouri state air pollution control program is administered by the Missouri Department of Natural Resources, Division of Environmental Quality, Air Quality Program. A total of 17 professional and technical personnel staff the Program. Of the 17 staff members, five and one-half person-years of effort are contributed by the regional offices. Unless the Clean Air Amendments are adopted, no more than four percent annum growth is expected for the state air program. If the Amendments are passed, ten more engineers would need to be hired.

The five local air pollution control agencies have a total of 60 professional and technical persons staffing the agencies. Sources suggest that little, if any, growth will take place in the staffing requirements of these agencies during the next five years.

Field research suggests that there are no more than 500 persons working in air pollution control in the private sector. Approximately 50 of these persons are consulting engineers. The majority of the non-consulting workforce is employed by the electric power, steel, lead smelting, and chemical industries. Sources indicate that the private sector may increase at an average per annum rate of between 3 and 5 percent over the next five years. Demand is expected to increase for both professionally and technically trained personnel.

II. NOISE

The Missouri Department of Natural Resources, the Missouri Department of Highways, and the Missouri Department of Transportation have limited noise control responsibilities.

The Department of Natural Resources employs one engineer who is assigned the responsibility of maintaining information on the current status of noise programs. The Department of Transportation is responsible for preparing Environmental Impact Statements for airport-related construction. This work is generally subcontracted to consultants. The Department of Highways performs noise studies prior to construction of new highways. The Department has one designated noise specialist, however, over 300 persons, mostly engineers, have some work in noise investigation and assessment.

Sources suggested that growth in the noise area will be dependent upon developments in both federal and state legislation. The Departments of Transporation and Highways expect minimal growth during the next five years. If the Department of Natural Resources were given authority for environmental noise control, additional persons would be hired.

Research indicates that there may be as many as 200 persons in the private sector and local government with part-time noise-related activities. Growth projections are not currently available on private sector activities.

III. PESTICIDES

The Missouri Department of Agriculture is the state lead agency for the operator certification and pesticide control program. The Department is staffed with a total of 25 professional and technical personnel who devote all or part of their time to pesticide programs. Over the next five years, the pesticide program anticipates increasing its staff by four positions, two area supervisors and two pesticide inspectors.

The Department of Social Services and the Cooperative Extension Service have a total of eighty professionals who are actively employed in pesticide-related activities. During the next five years, the Department of Social Services expects to increase its staff by a total of 11 persons, primarily chemists and sanitarians. No growth is projected in the Cooperative Extension Service.

Sources at the Department of Agriculture estimate that there are 12,000 commercial applicators, over 2,000 pesticide dealers, and 100,000 farmers in the state who are involved in pesticide application. No growth is expected in the private sector during the coming five years; in fact, experts estimate that the number of commercial applicators may decline as a consequence of the certification requirements. Growth beyond the current workforce levels ultimately will be dependent on whether there is a demand for commercial applicators to perform services previously handled through private applicators.

IV. POTABLE WATER

The Missouri Department of Natural Resources, Division of Environmental Quality, Water Supply Program has regulatory responsibility for the state's water supply program. The division headquarters is staffed by 12 professional and technical staff members, and the six regional offices contribute approximately nine person-years of support to the water supply program. No major increase in staff allocation to the potable water program is projected.

The Missouri Department of Social Services, Division of Health, Bureau of Laboratory Services provides analytical support to the Water Supply Program: five microbiologists allocate a portion of their time to potable water sample testing.

Experts in the state indicated that approximately 1,800 persons are employed by water supply treatment facilities in operational, maintenance, laborer, administrative, and supervisory capacities. Of this number, 552 persons are employed as certified water treatment operators. According to available information, staffing at the water supply treatment plants will increase by between 280 and 600 persons over the next five years, with the greatest increase in the 'C' and 'D' level plants.

The Safe Drinking Water Act is likely to increase the number of jobs for biologists, chemists, and laboratory technicians to conduct expanded sampling and analysis activities. The laboratory positions may more than double by 1982. It appears that these will not be state employees. If Region VII, EPA must open a field office, employees could number 49 by 1980.

V. RADIATION

Primary responsibility for radiation protection is vested in the Missouri Department of Social Services, Division of Health, Bureau of Radiological Health. The Bureau has a professional staff of three persons: 1 radiological health physicist, 1 biologist, and 1 mathematician. During the next five years, a staff increase of between 10 and 14 persons is desired. This anticipated growth is a result of the expanding workload and need for environmental monitoring near the proposed nuclear power site.

Private sector data concerning the number of individuals employed in radiation protection are not available. However, sources indicate that each of the 50 facilities using industrial X-ray devices is likely to have a safety officer, often an industrial hygienist, who is responsible for the proper use of equipment. It is further speculated that the 1,430 hospitals and clinics using medical diagnostic equipment may also have one person, frequently a health physicist, who is responsible for care of the equipment. No growth projections are available for this segment of the private sector.

Legislation is pending which would transfer the radiation program to the Department of Natural Resources. This action would expand the program to include monitoring radioactive waste disposal and transport of radioactive materials to and from nuclear facilities. If passed, this bill would have a significant impact upon program staffing.

VI. SOLID WASTE

The Missouri Department of Natural Resources, Division of Environmental Quality, Solid Waste Management Program administers the regulatory program for solid waste management in Missouri. The central headquarters and the six regional offices are staffed with a total of 10 persons: 4 engineers, 1 sanitarian, 1 scientist, and 4 others. Officials of the program anticipate a growth of from ten to twenty-five persons over the next three years, with the greatest staffing increment in the hazardous waste and resource recovery programs.

Estimates for the private sector solid waste workforce include 276 persons working in sanitary landfills, 12 persons in transfer stations, 4 persons employed at the two hazardous materials sites, and approximately 2,000 employees in collection systems. No specific workforce projections were obtained for the disposal workforce; however, sources in the field anticipate that the workforce in disposal may increase over the next five years as unlicensed dumps are closed and replaced with sanitary landfills. The workforce in the collection field is also expected to increase gradually as more municipalities implement mandatory collection systems and as population and the volume of solid waste generated grows.

At present there are no municipal resource recovery facilities; however, until recently there was an operable energy recovery demonstration project supported by EPA. Several agencies in the St. Louis area are investigating the feasibility of assuming responsibility for the site.

VII. WASTEWATER

The Missouri Department of Natural Resources, Division of Environmental Quality, Water Quality Program has regulatory responsibility for the wastewater pollution control program. The central headquarters and the six regional offices devote approximately 66 person-years of support to wastewater activities. This number includes 8 engineers, 10 scientists, and 48 others. An average annual growth of 5% is anticipated for the state program through 1981, with 10 of the positions allotted to the regional offices and 9 professionals added to the central headquarters staff. This growth will be necessary to deal effectively with "208" area wide planning and the growing workload associated with NPDES monitoring.

The Laboratory Services Division provides seven person-years of support to the Program. No growth is expected during the next five years. There are approximately 150 laboratories engaged in wastewater pollution control activities. There may be a total of up to 300 chemists and laboratory technicians employed in these laboratories.

Sources in the field indicate that there may be 2,000 operators and 1,000 additional persons involved in administration, maintenance, and labor in the municipal treatment facilities. Substantial growth in the number of operators is anticipated through 1980, with an average annual growth of 13%. While no specific figures are available, a concomitant growth is expected in the number of supportive staff members.

VIII. ENERGY

The Missouri State Government has one principal energy agency, the Missouri Energy Agency. The staff of the Agency is composed of six professionals, all of whom are degreed and have a variety of backgrounds including education, geology, political science, and sociology. Sources with the Agency anticipate an expansion in the staff will be necessary during the next five years. The Agency hopes to obtain an energy engineer and two other professionals in the coming years and about two professionals per year thereafter to 1982. These staffing increases will be dependent on the level of federal funding.

Data on the size of the private sector energy-related workforce are not currently available. Field research indicates that in the private sector most energy-related activities are conducted in the area of energy conservation. Numerous private industries are adding energy coordinators to their staffs. The coordinators are frequently responsible for supervising boiler operations, assessing long-term fuel supply, developing an energy conservation plan, and controlling pollution. Field research suggests that additional jobs may be generated in industry to coordinate energy conservation programs and to keep top management informed of energy-related legislation and regulations. Growth may also occur among consulting engineers to assist private industry in solving energy-related problems.

STATE OF MISSOURI - SUMMARY

National Environmental/Energy Workforce Assessment
Pollution Control & Abatement Personnel
Projected Workforce Requirements (1976-1981)

Environmental Area	1976	1977	1978	1979	1980	1981	%/annum growth (average)
AIR	580	598	613	629	645	662	3%
NOISE	586	586	586	586	586	586	0
PESTICIDES[1]	105	105	109	113	117	120	3%
POTABLE WATER	1,826	1,889	1,952	2,015	2,078	2,142	3%
RADIATION[2]	3	5	7	9	11	13	n/a
SOLID WASTE	2,303	2,309	2,315	2,321	2,327	2,333	0
WASTEWATER	3,373	3,950	4,171	4,386	4,601	4,604	7%
ENERGY	6	9	11	13	15	17	n/a
TOTALS	8,782	9,451	9,764	10,072	10,380	10,477	4%

[1]The above estimate does not include the 2,000 pesticide dealers, 12,000 owners, operators, and applicators, and the 100,000 farmers.

[2]This estimate includes projections for the state program; however, no information is included on the private sector.

[3]No private sector workforce projections are currently available.

EDUCATION

The higher education institutions in the State of Missouri offer a limited number of career options for students interested in pollution control and abatement occupations. Washington University, Central Missouri State University, Meramec Community College, University of Missouri, Crowder College, and the Water and Wastewater Technical School are among the educational institutions with environmental education program options.

An engineering curriculum with environmental emphasis is available through the University of Missouri at Rolla. Bachelor, Master, and Doctoral programs are offered in civil engineering through Washington University. Various environmental engineering courses are included within these curricula.

Two year training programs are offered at Central Missouri State University, Meramec Community College, Crowder College, and the Waste and Wastewater Technical School. A two-year Environmental Technology program is offered through Meramec Community College. Career training is available in water and wastewater treatment plant operation, sanitarian aide, public health engineering aide, stream sanitarian technician, and technical sales and service. Central Missouri State University offers an A.S. degree in Water and Wastewater Technology. Crowder College and the Water and Wastewater Technical School also award associate degrees in water and wastewater treatment plant operation.

LEGISLATION

The environmental/energy legislation for Missouri was obtained by request from various agency personnel and through various library references. Summaries of the legislation deemed most relevant to the eight subject areas of the workforce assessment were prepared, and are included in the respective state reports. The following list of laws represents virtually all environmental legislation for the state. Only certain of the following laws were summarized; the list is presented to show, by title, the kinds of laws which have been enacted.

Air Conservation Law

Pesticide Act of 1974

Economic Poisons Act

Radiation Control Law

Junkyards Law

Solid Waste Management Law

County Option Dumping Law

Clean Water Law

Waste Disposal Wells Law

Watercraft Sewage Disposal Law

National Environmental Energy Workforce Assessment

Phase I

MISSOURI

State Report

STATE PROFILE

Located near the geographical center of the United States, the State of Missouri provides a meeting place for northern and southern agriculture, as well as for eastern timber lands and midwestern prairie. This state ranks eighteenth in land area and fifteenth in population of the fifty states. It is a highly urbanized state which, however, still manages to retain the air of its rural, agriculturally based history.

Missouri is geographically divided into two types of terrain. The Missouri River divides the state into northern and southern segments. North of the river the land is characterized by open, fertile plains with rolling hills, plenty of water, and the corn and bean based farm economy that is also characteristic of much of the Midwest. South of the Missouri River the terrain roughens and becomes hilly, cut by streams and still retaining large areas of forest. Limestone caves abound, and many artificial lakes have been created by damming rivers and streams. The Ozark Mountains, though small by western standards, retain elements of the tough pioneers who settled in small, remote towns and farms generations ago. The Ozark region is now an important recreation area in Missouri. Tourism provides a stimulus to the local economy although social services are still lacking, and unemployment and poor farms keep the incomes of the area down relative to the rest of the state.

Missouri has two major urban areas, one on the east and one on the west border. St. Louis and Kansas City contain more than 60 percent of the state's population. These cities dominate the economy of the state, but the rural base of the state legislature gives the state's social policies a more conservative direction than many of the city dwellers would prefer.

These cities have lost many residents and jobs to the suburbs; thus, lowered tax rolls cause a decline in social services. This is particularly hard on the minority residents of St. Louis and Kansas City, and unemployment, substandard housing, and lack of opportunity cause great hardship.

The economic resources of the state are based on manufacturing and agriculture. Missouri is the industrial leader of all the adjacent states excepting only Illinois. Missouri ranks second in the nation in aerospace and transportation production. The state also leads the U.S. in lead production. Agriculture is responsible for over a billion dollars worth of production annually, and it ranks second in the state's economy after manufacturing and before tourism.

MISSOURI POLLUTION CONTROL AND ABATEMENT AGENCIES

The Department of Natural Resources is the principal state environmental agency. This agency has major responsibility for the air, potable water, solid waste, wastewater, and energy programs. The Department of Agriculture is the designated state lead agency for the pesticide applicator certification program, and the Department of Social Services administers the radiation protection program. There is no state noise legislation at the present time, but three state agencies, the Department of Natural Resources, Department of Highways, and Department of Transportation, have some noise control functions.

Within the Department of Natural Resources, the Division of Environmental Quality administers the air, potable water, solid waste, and wastewater programs, as well as soil and water and land reclamation functions. The total division complement is 156 persons of whom 108 are technical and professional and 48 are clerical and other support.

The Air Quality Program is conducted by 17 engineers, scientists, and technicians. The priorities of the program include attaining Primary Ambient Air Quality Standards for sulfur dioxide and total suspended particulates, developing an oxidant control plan for the St. Louis region, and ensuring that each major point source in the state achieves compliance with air quality standards.

The 21-member professional and technical staff of the Water Supply Program is currently concerned with fulfilling the requirements

of accepting primacy for the Safe Drinking Water Act. The voluntary operator certification program in effect at the present time may be converted to a mandatory program pending the decision of the General Assembly on proposed state potable water legislation. Thus, operator certification may become an important part of the state Water Supply Program's functions.

With a professional staff of ten persons, the Solid Waste Program has been involved in closing open dumps and replacing them with permitted sanitary land disposal sites and conducting a hazardous waste survey. Although no large-scale resource recovery facilities are now in operation in the state, the Solid Waste Program is encouraging their development for the larger towns and cities and provides technical assistance to municipalities that wish to conduct resource recovery feasibility studies.

The Water Quality Program has a professional and technical staff of 66 engineers, scientists, and administrators. In 1977, the voluntary certification program for wastewater treatement plant operators was replaced by a mandatory system, and Water Quality Program personnel are devoting increased effort to the certification of operators. Other functions of the programs are issuing permits for construction and operation of wastewater treatment facilities, monitoring and management planning of the water quality throughout the state, inspecting and monitoring water contaminant sources, investigating complaints from the public, and administering grants to municipalities and political subdivisions for constructing wastewater treatment works.

Over 50 percent of the budget of the Division of Environmental Quality comes from federal funds, thereby making the size of the environmental protection program heavily dependent upon the actions of the U.S. Congress. Accordingly, workforce projections are difficult to estimate, but the following are areas of possible program expansion over the next five years:

1) Implementation of a Radiation Protection Act which would move the regulatory program from the Department of Social Services to the Department of Natural Resources--five to 20 persons;

2) Implementation of state and federal hazardous waste legislation--ten to 20 persons;

3) Implementation of a dam safety program for Missouri--six to 15 persons;

4) Implementation of a Land Sales Act--eight to 15 persons;

5) Expansion of the state soil survey efforts with state funds--15 to 30 persons;

6) Expansion of state strip mining legislation to provide for addressing the orphan strip mine problem--three to five persons;

7) Creation of a state NEPA--three to 25 persons depending on the depth of program;

8) Development of a state land use policy and program--ten to 50 persons.

Also located in the Department of Natural Resources is the Missouri Energy Agency. This agency has a professional staff of six persons who are responsible for state energy planning, coordination of research and development, promoting conservation, and serving as a clearinghouse for energy information.

The Division of Plant Industries, Department of Agriculture, administers the pesticide applicator certification and pesticide control program. Twenty-five professional and technical personnel work in the pesticide control program and receive assistance from the University of Missouri Cooperative Extension Service and the Department of Social Services. The former organization trains private applicators, the only group of applicators for whom training is mandatory, and the latter agency conducts laboratory analysis of pesticide formulations and residues and monitors food for pesticide contamination.

The Bureau of Radiological Health, Division of Health, Department of Social Services, has primary responsibility for conducting the radiation protection program. Three persons comprise the professional staff of the Bureau of Radiological Health. The principal functions of the Bureau are administering the registration program and inspecting radiation sources. Since there are no nuclear power plants in the state, the Bureau has limited environmental monitoring functions.

With regard to noise, the Department of Natural Resources assigns an engineer to keep informed of federal noise legislation and regulations and noise-related developments on the local and state levels, the Department of Transportation is responsible for including noise studies in Environmental Impact Statements for airport-related construction, and the Department of Highways also preceeds construction projects with noise studies. Unless state noise legislation is passed, it is likely that the public and private sector workforce in environmental noise control and abatement will remain minimal.

Pollution Control and Abatement Programs

I. AIR

A. Introduction

The state air pollution control program is administered by the Missouri Department of Natural Resources (MDNR), Division of Environmental Quality, Air Quality Program (AQP). The responsibilities of the AQP, in order of priority designated in the Missouri Environmental Protection Consolidated Program Grant for Fiscal Year 1977, are as follows:

1) To identify and investigate the non-attainment areas within the state and develop methodologies to attain the Primary National Ambient Air Quality Standards (NAAQS) for SO_2 and TSP;

2) To develop an oxidant control plan for the St. Louis region which will consist of both mandatory and voluntary strategies to reduce oxidant levels within the St. Louis AQCR;

3) To inspect each major point source in the state annually and take necessary action to achieve final compliance;

4) To maintain through the DEQ Laboratory Services Program an ambient air monitoring network and to implement a formalized quality assurance program;

5) To review plans and specifications for new construction or modification of pollution sources and issue construction permits if proposed sources meet all applicable regulations;

6) To achieve and maintain compliance of minor sources in those portions of the state not classified as non-attainment areas. Investigations and enforcement actions will be carried out in response to complaints;

7) To review and modify the SIP when required, maintain an active alert plan for high air pollution episodes, coordinate and develop AQMA plans to maintain the NAAQS, and monitor and evaluate the effectiveness of local agencies in carrying out the SIP; and.

8) To maintain and increase the ability of the AQP in statistical information collection and reporting.

Supplementing the work of the state AQP are the efforts of five agencies which conduct local air pollution control programs. These programs operate in Green County-City of Springfield, City of Independence, Kansas City, City of St. Louis, and St. Louis County. The local programs carry out such activities as monitoring air quality, inspecting pollution sources, investigating complaints, issuing notices and summonses, reviewing plans for new installations, and conducting laboratory analysis.

The two major air pollution problems in Missouri are excessive quantities of total suspended particulates and sulfur dioxide emissions. These two substances are a particular problem in the St. Louis Air Quality Control Region (AQCR). A portion of the St. Louis AQCR has been designated as a non-attainment area for these pollutants since they exceed the limits of the State Implementation Plan. An area of Kansas City has also been designated a non-attainment area for total suspended particulates. To deal with the problem of carbon monoxide and oxidant emissions in the St. Louis AQCR, a tranportation plan was developed and approved by the Air Conservation Commission for St. Louis for Fiscal Year 1976.

In the private sector, the electric power, steel, lead smelting, and chemical industries conduct the majority of air pollution control activity in the state and employ the largest workforce in this area. The combined public and private sector workforce in air pollution control in Missouri may approach 600 persons. However, the majority of this workforce is involved in air pollution control activities on a part-time basis.

B. Workforce Profile

Information for the workforce profile was obtained through on-site and telephone interviews with professionals in the field of air pollution control in Missouri. Particularly helpful in the collection of this data was Mr. Mike Marshall, Staff Director, Air Quality Program, Division of Environmental Quality, MDNR.

The headquarters of the AQP is located in Jefferson City and is divided into an enforcement section and an engineering section. Six regional offices located in St. Louis, Springfield, Jefferson City, Kansas City, Poplar Bluff, and Macon also contribute to the AQP effort. The staffing level of the AQP, by position, is shown in Table I.

TABLE I

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Air Quality Program
Current (1976) Staffing Level

Position	1976
Engineer	5
Scientist	2
Technician	2
Other	8
TOTAL	17

In total, 17 person-years of effort were devoted to the state air program in 1976. Eleven persons, that is, five engineers, two scientists, two technicians, an information officer and a staff assistant operate from the Jefferson City headquarters. The last two positions are included in the "Other" category. The regional offices contribute five and one-half person-years to the air program. Personnel in the regional offices who devote time to this program are engineers and scientists. Because air pollution control responsibilities in the regional offices may be assigned to several staff members to carry out on a part-time basis, the precise number of involved engineers and scientists could not be ascertained, and the efforts of this staff are therefore included in the "Other" category. Also included in the "Other" category is the half-time assistance of an attorney whose services are purchased from the Office of the Attorney General.

The engineers are degreed and several are registered professional engineers. They have training in mechanical, civil, electrical, and chemical engineering and work either as environmental engineers or air pollution control specialists. The scientist category includes a chemist and a physicist, both of whom also work as air pollution control specialists. The technicians are not degreed and have been trained on-the-job for the position of air pollution control inspector.

In the Laboratory Services Program of the Division of Environmental Quality, three instrumentation technicians provide support to the AQP by conducting air quality monitoring.

Staffing for the local air quality control program includes an estimated 60 professional and technical persons. This workforce is composed primarily of engineers, chemists, inspectors, sanitarians, and attorneys who engage in activities similar to those of the state AQP.

Field research suggests that there are no more than 500 persons working in air pollution control in the private sector. Approximately 50 of these persons are consulting engineers and employed in about ten consulting firms in the state which conduct air pollution control work. As pointed out previously, the majority of the non-consulting workforce is employed by the electric power, steel, lead smelting, and chemical industries. Approximately half of this workforce consists of engineers and scientists, specifically civil, mechanical, electrical, and chemical engineers, chemists, and meteorologists. The other half of the workforce is composed of technicians, most of whom are skilled in instrumentation and electronics. Attorneys are also involved in air pollution control, but no workforce data on attorneys are available.

Air pollution control activities are carried out both by corporate environmental staffs and by plant engineering departments. Corporate environmental staffs are responsible for environmental policy planning, long-range planning of facilities and equipment, conducting environmental studies, preparing environmental reports for regulatory agencies, keeping top management informed of new rules and regulations, and providing technical assistance to plants in solving air pollution problems. Engineering departments are responsible for ensuring plant compliance

with air pollution control regulations, air quality monitoring, and operation and maintenance of air pollution control equipment. These departments may also be responsible for interior plant conditions, such as control of fumes and chemicals, in accordance with OSHA regulations, as well as control of ambient air pollution caused by plant operations.

Much of the professional and technical workforce does not devote full-time to air pollution control. Rather, these personnel may be involved in other environmental control activities, and frequently, they perform other functions that are not related to environmental control.

In filling professional positions in industry, companies tend to seek persons with experience in pollution control who have a knowledge of environmental regulations and technology. Consequently, recruitment is often conducted through advertisements in newspapers and professional journals; it may occur from within the company, or positions may be filled with persons recruited from governmental agencies. For technical positions recruitment often comes from within the company. Either persons who have requisite skills or persons who are thought to be easily trainable are chosen.

In summary, the majority of workforce involvement in air pollution control is occurring in the private sector, with most of the employment being for engineers, scientists, technicians, and attorneys. In the private sector there are an estimated 500 professional and technical personnel working in industry or for consulting firms in air pollution control activities on either a full- or part-time basis. In the public

sector, about 80 professional and technical personnel are engaged in the state and local air quality control programs. One-third of this workforce is employed in the state program and two-thirds are employed in the five local programs. Occupations predominating in the state and local programs are engineers, scientists, technicians, and sanitarians.

C. Workforce Projections

Workforce projections regarding the state and local air quality control programs are based on the best professional judgement of persons involved in these programs.

In 1977, three engineers were added to the AQP staff. Unless the Clean Air Act Amendments are passed, no further growth is expected in the state AQP. If amendments to the Clear Air Act are passed, ten additional engineers could be hired over the next five years. Assuming no change in federal air pollution control legislation, workforce projections for the AQP are as follows:

TABLE II

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Air Quality Program
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	5	8	8	8	8	8	n/a	12%
Scientist	2	2	2	2	2	2	n/a	0
Technician	2	2	2	2	2	2	n/a	0
Other	8	8	8	8	8	8	n/a	0
TOTAL	17	20	20	20	20	20		4%

If the Clean Air Act Amendments are passed and ten more engineers are hired, the average per annum growth rate for engineers would be about 37 percent and the aggregate average per annum growth rate for the AQP staff would approach 14 percent. The turnover rate for the professional and technical staff is about 3 percent per year. The turnover rate for professional engineers is expected to increase over the next few years because of the availability of jobs in the private sector which offer higher pay, more responsibility, and greater opportunities for advancement.

Staffing for air quality monitoring in the Laboratory Services Program is expected to remain at the current level of three instrumentation technicians over the next five years.

Sources employed in the local air pollution control programs suggest that little, if any, growth will take place in these programs' workforce over the next five years since funding allocations are not likely to increase. Several of these programs may, however, diversify into noise pollution control and consequently may experience small staffing increases for this purpose. Turnover in these programs is reported to be low in the more highly paid and skilled positions but is often a problem in the non-degreed positions because of low salaries and limited opportunities for advancement.

Workforce projections regarding the private sector were obtained through on-site and telephone interviews with public and private sector professionals engaged in air pollution control activities in Missouri. These sources were asked to provide their best professional

estimate of workforce projections for air pollution control for the next five years.

Field research indicates that the workforce engaged in air pollution control in the private sector may increase at an average per annum rate of between 3 and 5 percent over the next five years. The principal contributor to this growth will be an increase in monitoring and data evaluation activities necessitated by more stringent air pollution control regulations. Demand is expected to increase for both professionally and technically trained personnel. If a 3 to 5 percent per annum growth rate is sustained over the next five years, the private sector air pollution control workforce could increase by a total of between 75 to 125 persons.

It should be pointed out, however, that much of the current air pollution control workforce is engaged in air-related activities on a part-time basis. Thus, while growth might occur in the time devoted to air pollution control activities by this workforce, the number of new entrants to the private sector air pollution control field may be limited. As a consequence, the above workforce projections might more accurately be regarded as an expected increase in the number of person-years devoted to air pollution control work per year rather than as an indication of net new employment in the field.

Although some private sector workforce growth is predicted, minimizing the magnitude of growth is the fact that most companies developed and adequately staffed their environmental components in the early 1970s, and most are now in compliance with current air pollution

standards. Of the 259 major installations operating in the state, 246 are in compliance with emissions limits or have developed acceptable compliance schedules. Companies which are experiencing compliance problems or which require short-term assistance will often hire outside consultants rather than increase their own staffs. Sources in the field point out that out-of-state as well as Missouri based consultants are utilized for this purpose.

Clearly, public and private sector growth in the air pollution control workforce will be small. Aggregate growth for the public sector, that is, for the state AQP, the Laboratory Services Program, and the local air pollution control programs, may not exceed an average per annum rate of 1 percent. Overall per annum growth for the private sector over the next five years is expected to proceed at a rate of no more than 3 to 5 percent. It should be emphasized that the numbers involved in the private sector may be quite small if an increase in the number of person-years devoted to air pollution control activities per year is not accompanied by nearly commensurate growth in the workforce.

D. Training and Certification

Training for state and local air pollution control personnel is provided through attendance at EPA sponsored training seminars as well as through informal on-the-job training. In Fiscal Year 1976, 11 state and 34 local air pollution control personnel from Missouri attended the Air Pollution Training Institute located at Research Triangle Park, North Carolina. Courses offered through this

Institute range from orientation level training to highly technical instruction. In addition, the Division of Environmental Quality offers a course every six months for the recertification of visible emissions readers. The first session of the smoke reading course is three days in duration with the ensuing sessions being one day in length.

Public and private sector sources are aware of no comprehensive university or vocational/technical programs designed to train air pollution control professionals or technicians, although the University of Missouri at Rolla offers an M.S. in Environmental and Planning Engineering which includes instruction in air pollution abatement. Field sources indicate that training is inadequate at the A.A. or one-year certificate level for technicians in monitoring, measuring, and instrumentation.

E. Career Potential

Little workforce growth is likely to occur over the next five years in air pollution control in the public and private sectors. Accordingly, career opportunities will be limited. While there is a need for highly trained engineers and scientists to design effective equipment for private industry, funds for this purpose may not be forthcoming from the private sector. Technicians skilled in mechanics and electronics are also utilized both in government and in industry but, again, limited workforce growth will tend to restrict career opportunities in this area.

The state AQP has submitted a proposal to develop an inspection-maintenance auto emissions program to become effective in 1978. The implementation of such a program would create positions for technicians who are skilled in auto mechanics, especially those trained in the operation, repair, and maintenance of emission control systems. However, it is doubtful that funding will be provided for an auto emissions control program. Sources in the field indicate that they are aware of no unique or new careers emerging in the air pollution control field.

F. Conclusion

The air pollution control field is staffed primarily by engineers, chemists, sanitarians, technicians, and attorneys, with growth in the field and career opportunities quite restricted. There will be few workforce opportunities in the public sector in either the state or local air pollution control programs because of restricted funding. If amendments to the Clean Air Act are passed, however, ten engineers in addition to those shown in the Table II workforce projections will be added to the AQP staff.

The rate of growth for the private sector is limited since most companies developed and adequately staffed their environmental component in the early 1970s. Although person-years of effort devoted to air pollution control in the private sector are projected to increase at an average per annum rate of 3 to 5 percent, growth in the number of new entrants into the private sector air pollution control workforce

may not increase commensurately since persons currently working part-time in air pollution control may simply devote more time to this function.

Field research did not reveal any comprehensive air pollution control programs offered by the state's colleges, universities, or vocational/technical institutions. Professionals in the field suggest that vocational/technical institutions provide more rigorous training at the technician level in monitoring, measuring, and instrumentation.

II. NOISE

A. Introduction

Missouri has no noise legislation at the state level although proposed legislation to give the state responsibility for establishing and enforcing environmental noise standards is currently in committee and is supported by industry. While there are no agencies in the state that conduct extensive noise control activities, the Missouri Department of Natural Resources (MDNR), the Missouri Department of Highways (MDOH), and the Missouri Department of Transportation (MDOT) do have some noise control functions. St. Louis County has an active local noise control program, and several of the five local air pollution control agencies anticipate that their duties may diversify into the community noise control area. In Missouri, eight jurisdictions have municipal noise ordinances.

B. Workforce Profile

Information for the workforce profile was obtained through on-site and telephone interviews with professionals in noise control in the public and private sectors. In the MDNR, Division of Environmental Quality, Air Quality Program one engineer is assigned the task of keeping abreast of federal noise legislation and regulations and noise-related developments on the local and state levels. The workforce here is minimal because the MDNR has no legal authority to conduct a noise control program.

The MDOT is responsible for preparing Environmental Impact Statements for airport-related construction. This work is generally done by consultants to the Department. Sources in the field estimated that there are 28 firms involved in noise-related consulting and that each firm has an average of three civil engineers with expertise in noise.

In the MDOH, new construction is also preceeded by noise studies. Over 300 persons, mostly engineers, may do some work in relation to noise investigation and assessment for proposed projects. However, the Department has one designated noise specialist. The specialist is a registered professional engineer with training in civil engineering. Eight cities have municipal noise ordinances. The cities and the types of ordinances are shown in the table below. This table is adapted from Sound and Vibration, December, 1975, Clifford R. Bragdon, Contributing Editor.

TABLE III

Municipal Noise Ordinances

City	Nuisance	Zoning	Vehicle	Rec/ Vehic.	Railroad	Aircraft	Construction	Building
Bridgeton	0	-	-	-	-	-	-	-
Gladstone	0	-	X	-	-	-	X	-
Grandview	0	-	0	-	-	-	0	-
Independence	0	X	0	-	-	-	-	-
Kansas City	0	X	X	-	-	-	-	-
St. Louis	0	X	X	0	-	-	X	-
Springfield	0	-	0	-	-	-	-	-
Waynesville	0	-	0	-	-	-	-	-

KEY: X denotes regulation that includes acoustical criteria
0 denotes regulation that does not include acoustical criteria
- denotes no regulation

These ordinances are usually enforced by local law enforcement authorities. The omission of acoustical criteria means that the regulations are nonquantitative and therefore difficult to enforce. According to field research most of these ordinances are not being actively enforced and, furthermore, with the exception of St. Louis County, no communities in the state have active noise control programs.

Field research suggests that including OSHA, private sector, and local government personnel, there may be as many as 200 persons in the state involved in noise control do so on a part-time basis as an adjunct to other job responsibilities. The Midwest Noise Council, Inc., an organization of professionals in the noise control field, is based in St. Louis, Missouri. It has approximately 100 members, many of whom represent industry, universities, and government throughout the state.

C. Workforce Projections

Sources at the various state agencies that conduct noise control activities indicated that growth in the field will be dependent upon developments in both federal and state legislation. Unless the workload in noise control increases substantially, neither the DOT nor the DOH expects any growth in the noise control workforce. If the MDNR should be given authority for environmental noise control, additional persons would be hired, probably in the Air Quality Program. However, until state noise control legislation is passed, the magnitude of this growth cannot be predicted. Also, several local air pollution control programs anticipate the possible assumption of noise control functions

and a consequent staff increase but, again, the magnitude of increase cannot yet be predicted.

Currently, environmental noise pollution control is not recognized as a distinct professional area, and public interest in noise control remains at a relatively low level. Sources in the field expect that as federal regulations regarding noise become more stringent and as public awareness increases, growth will occur in the workforce involved in noise control on both the professional and technical levels. However, field sources could not provide specific workforce projections.

D. Training and Certification

Training is held in various locations in the state for noise control professionals by the Federal Highway Administration and EPA. The University of Missouri at Columbia and at Rolla offer noise-related courses in their mechanical engineering departments. Field research indicates that no programs are available through educational institutions in the state which emphasize methods of noise control and abatement.

E. Career Potential

Workforce growth in noise pollution control appears to be limited over the next several years, but several noise-related occupations may develop slowly. Growth may occur in such activities as predicting noise levels, writing noise regulations, developing quieter mechanical devices for both industry and the home, enforcing noise ordinances, measuring noise levels, and maintaining equipment used to control and measure noise.

Professional level training in engineering, science and law will be necessary for persons involved in equipment design and development, research, noise level prediction, and development of regulations. Community colleges and vocational/technical institutions can provide training for personnel in technical positions. Technical positions may include enforcement, monitoring, and equipment maintenance.

F. Conclusion

Although noise control activities in Missouri are presently restricted, development in this area can be expected to occur as federal regulations become more stringent and as public cognizance of the fact that noise can be controlled increases. These factors will promote an increase in the demand for engineers, scientists, and attorneys, as well as for persons with appropriate technical training for enforcement, monitoring, and equipment maintenance. As development in this field progresses, program development and upgrade/enrichment courses will be necessary for persons involved in noise control in both professional and technical capacities.

III. PESTICIDES

A. Introduction

The Missouri Department of Agriculture is the designated state lead agency for the operator certification and pesticide control program. Within the Department of Agriculture, Division of Plant Industries, the Bureau of Pesticide Control and Bureau of Plant Pest Control are responsible for carrying out the pesticide program. The Division of Plant Industries administers the state pesticide laws and regulations including conducting the programs for registering pesticide products and licensing pesticide dealers, operating the applicator certification program, monitoring retail outlets and pesticide applicators, and inspecting pesticide product labels, feeds, and seeds.

Other agencies which cooperate in the pesticide control program are the University of Missouri Cooperative Extension Service and the Missouri Department of Social Services. The Cooperative Extension Service is responsible for training private pesticide applicators and for lending support to the Department of Agriculture in the operator certification program. In the Department of Social Services, Division of Health, the Bureau of Laboratory Services provides support for the pesticide program by conducting analyses of pesticide formulations and residues. Also in the Department of Social Services, Division of Health, the Bureau of Community Sanitation monitors food for pesticide contamination.

Sources in the pesticide field in Missouri indicated that, in general, the state experiences few pesticide problems. Perhaps the most

serious pesticide problem for which a solution has not been found is that of container disposal. Other problems include completing the rather prodigious task of training and certifying applicators to use restricted pesticides, determining which pesticides will be restricted or banned, and assigning liability in case of accident in situations for which the consultation of a PEPS 5 "knowledgeable expert" is utilized.

B. Workforce Profile

Data for the workforce profile and workforce projection sections have been obtained through on-site and telephone interviews with professionals in the pesticide field. Mr. Rayford Thompson, Director, Division of Plant Industries, Missouri Department of Agriculture offered valuable assistance in the collection of these data.

Within the Plant Industries Division, 25 professional and technical personnel devote all or part of their time to the pesticide program. The staffing level of the pesticide program, by position, is shown in the following table.

TABLE IV

MISSOURI DEPARTMENT OF AGRICULTURE

Pesticide Control Program
Current (1976) Staffing Level

Position	1976
Entomologist	6
Technician	3
Other	16
TOTAL	25

The entomologists have bachelor or master degrees in entomology. The technicians hold associate degrees. The "Other" category includes persons with associate or bachelor degrees in either a biological or agricultural science, as well as persons experienced in pesticide application and regulation. Eight of the above staff members hold the position of area supervisor and devote 25 percent of their time to the pesticide control program. Eight other staff members are involved full-time in certifying commercial applicators, and nine persons work in ancillary capacities in feed, seed, and economic poison inspection.

In the Cooperative Extension Service, 35 agronomists and horticulturists throughout the state and six state extension staff are involved in training private applicators. Three environmental health chemists contributed a total of about one-person year of effort in 1976 to pesticides in the Chemistry Unit of the Bureau of Laboratory Services. In the Bureau of Community Sanitation, 36 environmental sanitarians devote approximately 20 percent of their time to pesticide-related activities.

Sources at the Department of Agriculture estimate that there are 3,000 commercial applicators and up to 40,000 private applicators who may require certification to achieve the requirements of federal and proposed state legislation. In addition, there may be over 2,000 pesticide dealers who also require licensing to meet state regulations.

The total estimated pesticide control picture is reflected by the following table in which figures are approximations of the workforce engaged in pesticide application or regulation on either a full- or part-time basis:

TABLE V

Current (1976) Missouri Pesticide Workforce Staffing Levels for both the Public and Private Sectors (est.)

Public Sector	1976
Department of Agriculture	25
Department of Social Services	39
Cooperative Extension Service	41
TOTAL	105
Private Sector	
Farmers	100,000
Owners/Operators/Applicators	3,000
TOTAL	103,000

Although there are approximately 100,000 farmers in Missouri, no more than 40,000 are expected to obtain certification to apply restricted use pesticides. Sources in the field estimate that in addition to the 3,000 commercial applicators who will become certified, approximately 9,000 persons work as applicators or crew members but will not seek certification. It should be noted that some applicators included in the commercial category are actually government employees who apply restricted use pesticides. However, sources in the field could not provide estimates of the number of government employees included in the commercial category. Thus, in Table V, the public sector figures tend to underestimate the magnitude of the governmental pesticide workforce, while the private sector figures tend to overestimate the numbers of persons who apply restricted use pesticides for profit.

In summary, then, over 100 public sector professional and technical personnel are involved in pesticide control or usage. Their activities include inspection, enforcement, advising, laboratory analysis and application. In the private sector, there are an estimated 12,000 persons working as owners, operators, applicators or crew members and over 2,000 pesticide dealers. About 40 percent of the 100,000 farmers will obtain certification to apply restricted use pesticides.

C. Workforce Projections

Two field inspectors as well as two clerical personnel were added to the staff of the Plant Industries Division in 1976 to assist with the certification program. Over the next five years, the pesticide program staff is expected to increase by four persons, that is, two area supervisors who will work in pesticides on a part-time basis and two pesticide inspectors who will be involved in the program full-time. The Chemistry Unit of the Bureau of Laboratory Services may grow by two chemists because of an increasing workload. New personnel will perform pesticide analysis in addition to other duties. The Community Sanitation Bureau may also increase its staff of sanitarians by about nine people over the next five years. Some of this staff increase is expected to be devoted to pesticide-related activities. Turnover among the staffs of these agencies is reported to be minimal.

Field research suggests that in the next several years there will be a net decline in the number of persons employed in commercial application of pesticides. Contributing significantly to this decline is the

certification requirement. In previous years, turnover among commercial applicators tended to be replaced by the entry of new applicators. With the advent of FIFRA and its amendments, however, sources in the field anticipate that some of the turnover will not be replaced. Some of the larger companies may expand somewhat to compensate for the reduction but it is unlikely that the larger companies will be able to compensate fully for the attrition of commercial applicators. Thus, an unanticipated consequence of more stringent pesticide controls may be to promote the monopolization of the commercial applicator industry in the state. Moreover, a reduced workforce in commercial applications and increased monopolization of the industry could lead to higher prices for the service, at least on a temporary basis.

After the initial market adjustments occur, the decline in workforce is expected to level off and the workforce may, in fact, increase. Growth beyond the current workforce levels ultimately will be dependent on whether there is a demand for commercial applicators to perform services previously done by private applicators.

Turnover rates among members of commercial applicator crews may be as high as 40 percent per year. The high turnover rate results from the seasonal nature of the job, poor working conditions, and low pay.

D. Training and Certification

Training is mandatory only for private applicators who wish to use restricted pesticides. The training is conducted by the University of Missouri Cooperative Extension Service. In 1976, approximately 20,000 private applicators had taken the training which covers such topics as

safety, calibration and application, types of pesticides, and the three general pest groups--insects, diseases, and weeds. Examinations for commercial and private applicator certification and for pesticide dealer licensing are administered by the Department of Agriculture. By the end of 1976, approximately 2,000 commercial applicators and 2,000 dealers had taken the appropriate examinations.

State Fair Community College in Sedalia, Missouri, offers a two-year pesticide technology program. In 1976, four persons graduated from the program and obtained jobs as commercial applicators.

E. Career Potential

The above analysis suggests that career opportunities in the field of pesticides in Missouri will be limited. Little growth is projected for the state agency staffs involved in pesticide control. The number of commercial applicators may well decline in the next several years because of the stringency of FIFRA requirements. Field research suggests, however, that integrated pest management will assume increasing importance over the next several years because of the growing stringency of requirements governing the use of pesticides and increasing public sentiment against the excessive use of chemical pest controls in agriculture. Accordingly, career opportunities may develop for persons with agricultural science backgrounds who can serve as integrated pest management consultants. In addition, there may be opportunities at the technical level for persons with short course backgrounds.

F. Conclusion

Employment opportunities in pesticide application and regulation appear to be extremely limited over the next five years. However, some careers in the area of integrated pest management may develop as federal and state regulations become more stringent and as more integrated pest management research becomes available. Consequently, the demand for trained personnel may develop, and both universities and vocational/technical institutions may find a market for graduates trained in integrated pest management.

Field research indicates that a significant consequence of the certification requirement for commercial applicators will be a decline in their numbers over the next several years. A number of the small applicators may find it difficult to obtain certification and some are therefore expected to leave the business and not be replaced, at least for several years. While some of the larger commercial applicators will expand their operations to compensate for the attrition, it is unlikely that they can fully replace the number of applicators lost. Therefore, it appears that in the short-run, at least, there will be increased monopolization of the industry and reduced employment, a situation which could lead to higher prices for the service. In the longer term, it is likely that the workforce may increase to the same level as it is currently. Further growth will be dependent primarily upon whether there is a demand for commercial applicators to take over for private applicators.

Sources in the field do not yet know what the effect of the PEPS 5 program will be. Sources do point out that there is a potential problem in that the regulations are ambiguous concerning liability if a "recognized expert" provides faulty information which causes damage to people or to the environment.

IV. POTABLE WATER

A. Introduction

The state water supply regulatory program covers approximately 1,040 water supply systems. Types of supplies covered include city/community, subdivisions, mobile home parks, and water districts. All these types of supplies will be classified as community water supplies under the Safe Drinking Water Act, for which, it appears, the state will not assume primacy. At present, Missouri does not have a mandatory certification program for waterworks operators, although a voluntary certification program is conducted by the Missouri Operator Certification Board. The Missouri Department of Natural Resources (MDNR) has introduced legislation into the Missouri General Assembly to bring existing water supply regulations into compliance with the regulations of the Safe Drinking Water Act. If this proposed legislation is passed into law, a mandatory certification program for water supply system operators will be developed and maintained.

Water supply facilities are classified according to a system of points which assigns values based on the complexity of operation as well as on the capacity of the facility. The most complex and high capacity facilities are classified as 'A' systems, and the 'B', 'C', and 'D' classifications denote progressively simpler and lower capacity systems. The voluntary operator certification system and the classification system which will be used if a mandatory program is instituted are also based on this scheme of classification. The mandatory system,

if utilized, will require that the operator in responsible charge of a system be certified at the level of the system or at a higher level.

About 40 of the water supply facilities serve a comparatively large population and have a diversified staffing complement which may include a superintendent, shift operators, and maintenance, labor, and administrative personnel. The remaining plants are smaller, many of them employing just one operator and some having an operator and a maintenance worker. Currently there are 21 in-plant, two private, and nine local health department laboratory facilities which provide services for community type water systems. The estimated total staffing level for the Missouri water supply program including personnel at the water supply treatment facilities, laboratory personnel, and the state regulatory staff is approximately 1,850 persons.

The MDNR, Division of Environmental Quality, Water Supply Program (WSP), has regulatory responsibility for the state's water supply activities. The responsibilities of the WSP, in order of priority designated in the Missouri Environmental Protection Consolidated Program Grant for Fiscal Year 1977, are as follows:

1) To ensure that water dispensed to the public meets the applicable drinking water standards through monitoring water quality and improved operation. This includes encouraging voluntary operator training and certification;

2) To review reports, plans and specifications, construction inspections, permits issued, and administration of state grant program for water facilities;

3) To conduct field activities through the Regional Office Program in support of the WSP including inspection of water supply facilities, preliminary site surveys, well groutings, final inspections, meetings with owners and officials, and designated activities related to the Safe Drinking Water Act;

4) To develop and adopt state primary drinking water standards at least as stringent as the national standards;

5) To implement procedures as necessary to enforce the Safe Drinking Water Act, including expanding the EDP system to accommodate new supplies listed as a result of the Act, inspection of new supplies, expansion of laboratory certification and quality assurance programs, and assurance of availability of laboratory facilities;

6) To review the present internal record-keeping and reporting system and revise as necessary to fulfill the information requirements of the Safe Drinking Water Act and to inform the public and water supply officials of the reporting requirements of the Act;

7) To develop and implement a procedure for granting variances and exemptions;

8) To upgrade and enhance the state emergency water supply plan.

Primary responsibility for training water supply treatment facility personnel rests with the regional office personnel. The Division of Environmental Quality maintains six regional offices which devote about 20 percent of their time to the WSP. Staff of the regional offices provide limited on-the-job training as part of the inspectional program and assist water treatment facilities in emergencies and in special problem situations. During 1977, the WSP has planned training programs to instruct operators in the technique for monitoring turbidity as required by the Safe Drinking Water Act, and water purveyors

will be contacted to determine who will provide in-house microbiological analyses and analyses for organic and inorganic contaminants.

B. Workforce Profile

Information for the workforce profile was obtained through on-site and telephone interviews with personnel from the MDNR, WSP, and the Missouri Department of Social Services, Bureau of Laboratory Services. Of particular assistance in the collection and compilation of this data were Mr. William Ford, Chief Engineer; Mr. Robert Miller, Director, Bureau of Environmental Engineering; and Mr. Donald Sisson, Waterworks Supervisor, WSP, MDNR and Mr. Edward Lightfoot, Regional Office Director, Division of Environmental Quality, MDNR.

As pointed out above, the WSP of the Division of Environmental Quality, MDNR is carried out through its headquarters in Jefferson City and six regional offices which are located in St. Louis, Springfield, Jefferson City, Kansas City, Poplar Bluff, and Macon. At Jefferson City headquarters, the program is divided into five sections: Administrative Support Section, Data Management Section, Engineering and Construction Section, Enforcement Section, and Water Quality and Operations Section. At headquarters, the WSP has a professional and technical staff of 12 members. The six regional offices contributed nine person-years of effort to the WSP in Fiscal Year 1976. The current staffing level of the WSP, by position, is shown in Table VI.

TABLE VI

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Water Supply Program
Current (1976) Staffing Level

Position	1976
Engineer	5
Technician	1
Other	15
TOTAL	21

The engineers hold the position of environmental engineer. All are degreed engineers, and three are registered professional engineers. The technician holds an associate degree from a technical institution. The "Other" category includes one writer, three waterworks supervisors, one planning project supervisor, and the program director, who also is a registered professional engineer and has a master's degree in public health. Also included in the "Other" category is the effort of the regional offices which contributed an estimated nine person-years to the WSP in 1976. Regional office personnel who devote time to this program are engineers, scientists, and experienced water supply treatment facility operators. Because WSP activities in the regional offices may be assigned to several staff members to carry out on a part-time basis, the precise number of personnel could not be ascertained, and the person-year efforts of this staff are therefore included in the "Other" category.

The position of waterworks supervisor in the WSP requires several years of on-the-job experience in water supply treatment operations. Currently, there are three waterworks supervisors working in the

central office and one in a regional office. All are certified operators. When full program staffing is achieved, each regional office will have a waterworks supervisor. This person is responsible for training operators on-the-job, conducting plant inspections and troubleshooting at the treatment facilities. WSP officials note that the knowledge and experience of the waterworks supervisors renders them extremely effective in training treatment plant personnel, handling emergencies, and dealing with in-plant problems on a day-to-day basis.

The Missouri Department of Social Services, Division of Health, Bureau of Laboratory Services provides analytical support to the WSP. In the Microbiology Unit, five microbiologists devote part of their time to potable water testing. In addition, the 21 in-plant, two private, and nine local health department laboratories may employ up to 20 persons in water supply testing. Some of the in-plant laboratories are run by a plant operator or an assistant. The following table illustrates the distribution of treatment plant operators certified under the voluntary program by operator classification.

TABLE VII

Current (1976) Certified Water Treatment System Operators (Voluntary Program)

Classification	1976
A	43
B	47
C	158
D	304
TOTAL	552

The 'A' certification has the most stringent requirements and the 'D' certification has the least stringent requirements. It should be emphasized that 552 operators are certified under the voluntary program of the Missouri Operator Certification Board. Although sources in the field could not provide information on the number of non-certified operators working at water treatment facilities, they estimate that a total of approximately 1,800 persons are employed by water supply treatment facilities in operational, maintenance, labor, administrative, and supervisory capacities.

In total, then, there are approximately 1,850 persons in the state working in the water supply field in the public and private sectors.

C. Workforce Projections

Workforce projections are based on the best professional judgement of personnel in the WSP. Information was obtained through on-site and telephone interviews.

In Fiscal Year 1976, the WSP added twelve persons to its staff to carry out the provisions for accepting primacy under the Safe Drinking Water Act. Over the next five years, growth of about 16 additional positions is expected to occur, it appears that these positions will form a Region VII Field Office to implement SDWA in Missouri. Should the state not assume primacy by the end of 1979, the federal office may total 49 persons, who might otherwise be employed by the state. Table VIII illustrates projected growth rates to 1982.

TABLE VIII

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Water Supply Program and/or Region VII Field Office
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)
Engineer	5	7	12	19	21	21	n/a
Technician	1	3	4	6	7	7	n/a
Other	15	21	30	40	42	42	n/a
TOTAL	21	31	46	65	70	70	

Sources at the WSP could not provide specific turnover rates for the program staff. However, they indicate that turnover is minimal for central office professional and technical personnel and less than ten percent per year for the professional and technical staffs of the regional offices.

The Region VII Field Office may include seven engineers, four data processers, two technicians and four secretaries soon after it is established. Engineers, laboratory personnel and field inspectors are expected to be added.

WSP sources point out that the planned construction of 30 new water treatment plants combined with the mandatory certification requirement, should it become law, will necessitate an increase in the number of certified operators in the 'C' and 'D' classifications as well as in the number of other personnel employed at 'C' and 'D' level plants. In contrast, the 'A' and 'B' plants are not expected to require an increase in staffing over the next five years.

Enforcement of the Safe Drinking Water Act will increase the amount of required bacteriological and chemical sampling. Professionals in the field project that the current workforce of 20 persons engaged in water supply analysis may increase to about 50 persons over the next five years; apparently these will not be state employees.

According to available information, staffing at the water supply treatment plants will increase by between 280 and 600 persons over the next five years. This staffing increase will be for 'C' and 'D' level plants, with staffing at the 'A' and 'B' level plants expected to remain constant, Thus, the average per annum growth rate for the 'C' and 'D' plants will be between 5 and 10 percent per annum. In aggregate, the workforce employed by water supply treatment operations will increase at an average per annum rate of between 3 and 7 percent, that is, from 1,800 to between 2,080 and 2,400 persons. Finally, the Safe Drinking Water Act is likely to increase the number of jobs for biologists, chemists, and laboratory technicians to conduct expanded sampling and analysis activities. These laboratory positions may more than double by 1982.

D. Training and Certification

The waterworks supervisors of the WSP conduct most of the on-the-job training of operators who are employed in water supply treatment facilities. The Water and Wastewater Technical School, located in Neosho, Missouri, also contracts with MDNR to provide formal training to water supply treatment plant personnel. In previous years, training has been accomplished through seminars held across the state on a variety of subjects. In Fiscal Year 1977, a new training program will

be instituted. It will consist of a course held at 11 different locations throughout the state. Operators will receive eight days of training which will be provided one day per week for eight weeks. WSP officials expect to train approximately 220 operators through these courses. Upgrade training for treatment plant personnel, as well as for the state regulatory staff, is provided by the Missouri Section of the American Water Works Association through meetings, seminars, and training courses.

A joint program offered by the Water and Wastewater Technical School and Crowder College, a two-year community college, provides an associate degree in water and wastewater treatment plant operations. Between 100 and 125 students graduate from this program each year. About 16 percent obtain jobs as water plant operators or superintendents and about 13 percent become employed in both water and wastewater operations simultaneously. The remaining 71 percent become wastewater plant operators and superintendents, laboratory technicians, and regulatory personnel. The University of Missouri at Rolla offers an M.S. degree in Environmental and Planning Engineering. This curriculum includes courses in water treatment.

Field research suggests that three training-related problems exist for water supply system operators in Missouri. First, and perhaps most importantly, many of the smaller utilities cannot afford the expense of travel and tuition to training courses. Consequently, many operators of the smaller utilities are running the systems with insufficient background and training. Hiring of waterworks supervisors in the WSP to provide on-the-job training and the provision of

the short courses held at eleven locations in the state are designed to address this difficulty. Second, sources in the field point out that home study courses would be a useful adjunct to the instruction provided by the WSP, the Water and Wastewater Technical School, and the American Water Works Association. Finally, field sources indicate that short courses often are not sufficiently intensive or extensive and that longer, in-depth courses would, in some cases, be preferable, especially for intermediate and advanced training.

E. Career Potential

Due to the requirements of the Safe Drinking Water Act, jobs will become available for some engineers, scientists, technicians and experienced water supply treatment personnel. There will also be opportunities for chemists, biologists, and laboratory technicians in public and private sector laboratories because of increased bacteriological and chemical sampling required by the Safe Drinking Water Act.

Because of the probable initiation of a mandatory operator certification program and the planned construction of 30 additional treatment facilities, water treatment plants will require an increase in the number of certified operators and in other types of treatment plant personnel over the next five years. Specifically, a five to ten percent per annum increase is expected in personnel required for 'C' and 'D' level plants. This means that between 56 and 120 new personnel may be hired each year for the next five years. Thus, jobs will increase in operational, maintenance and labor positions.

In addition, the turnover rate in the 'C' and 'D' plants of between 15 and 20 percent per annum indicates that there are continual openings available for new personnel. However, this high rate of turnover also indicates that there may be undesirable aspects to this job. As suggested above, the factors contributing most to the high turnover are the low salaries and limited opportunities for advancement at many of the smaller utilities. This situation not only causes high turnover rates but also necessitates the hiring of untrained, less qualified personnel at the smaller utilities.

F. Conclusion

The foregoing suggests that the area of greatest workforce need is in water treatment operations, labor, and maintenance as well as in laboratory activities. This is the result of the prospective mandatory operator certification program and expanded sampling and analysis, both necessitated regardless of whom assume primacy for the Safe Drinking Also contributing to these areas of workforce need is the anticipated construction of 30 water supply treatment facilities.

A serious problem that exists for Missouri is ensuring adequate training for operators of the smaller rural water supply systems. As pointed out previously, many communities cannot afford to send their operators to training sessions. To exacerbate this problem, operators with no prior experience in the field are frequently hired and consequently require formal training to supplement skills acquired on the job. The high turnover rates in the smaller systems dictate that new

operators continually be trained. Other needs with regard to operator training include a need for home study materials to supplement the short courses offered by the state WSP staff, the Water and Wastewater Training School, and the American Water Works Association and longer and more intensive upgrade and advanced course offerings.

V. RADIATION

A. Introduction

Primary responsibility for radiation protection is vested in the Missouri Department of Social Services (MDSS), Division of Health, Bureau of Radiological Health. This Bureau is responsible for carrying out the following functions:

1) Develop comprehensive policies and programs for the evaluation and determination of health hazards associated with the use of radiation and for their abatement and elimination;

2) Encourage, participate in, or conduct research, investigations, training, and demonstrations relating to the control of radiation hazards, the measurement of radiation, and the effects on health of exposure to radiation;

3) Collect and disseminate information relating to the determination and control of radiation exposure and hazards;

4) Review and approve plans and specifications for radiation sources;

5) Administer a registration program for production, use, storage, and disposal of radioactive materials or radiation machines;

6) Inspect radiation sources, their shielding and immediate surroundings and records for the determination of any possible radiation hazard and examine any records or memoranda, as necessary, pertaining to the question of radiation machines and the use of radioactive materials;

7) Respond to public health emergencies or incidents involving radioactive materials.

Missouri is not an NRC agreement state.

B. Workforce Profile

The Bureau of Radiological Health has a professional staff of three persons to carry out the activities described above. The staff is composed of one radiological health physicist, one biologist, and one mathematician. All staff members have a bachelor's degree, at minimum. Because Missouri has no nuclear power plants at the present time, this staff conducts limited environmental monitoring activities.

Private sector data concerning the number of individuals employed in radiation protection are not available at this time. The number of facilities in Missouri using industrial X-ray devices is 50. Each of these facilities is likely to have a safety officer, often an industrial hygienist, responsible for the proper use of the equipment. In addition, 960 hospitals and 480 clinics using medical diagnostic machines may also have one person in each facility responsible for the equipment. These persons may be health physicists, although this may not be true in the smaller clinics.

C. Workforce Projections

Sources at the Bureau of Radiological Health indicate that over the next five years, a staffing increase of between ten and fourteen persons is desired. Some of the staffing increase would be devoted to environmental monitoring in the vicinity of the one nuclear power plant which is planned for operation in 1981, in Calloway County. Because present staff is insufficient to handle the current workload adequately, the Bureau would like to obtain three or four of these persons as soon as possible. The magnitude of staffing increase that

actually does occur over the next five years will depend upon the decisions of the General Assembly. If positions do become available, they will be filled by degreed scientists, preferably persons with health physics backgrounds.

The Missouri Department of Natural Resources (MDNR) has introduced into the General Assembly a Radiation Protection Act which would transfer the radiation protection program from the MDSS, Division of Health to the MDNR, Division of Environmental Quality. This legislation is still in committee. Sources at the MDNR anticipate that, if the proposal is passed into law, between five and twenty persons would be added to the radiation protection staff. The proposed act would expand the state program to include monitoring radioactive waste disposal and transport of radioactive materials to and from nuclear facilities. The nuclear power plant which is planned for operation in 1981 will employ health physicists and other radiation protection personnel.

D. Training and Certification

The Bureau of Radiological Health utilizes available federal training programs offered throughout the country. In addition, new entrants to the Bureau receive informal on-the-job training. The University of Missouri has a Nuclear Training Reactor which is used for research and training by many of the departments in the University. It also offers a nuclear engineering curriculum at both the undergraduate and graduate levels.

E. Career Potential

Field research suggests that career opportunities in the radiation protection field in Missouri will be limited. Some positions may become available in the state regulatory program, whether it remains in the MDSS or moves to the MDNR. The magnitude of growth is dependent upon the action of the General Assembly. The planned nuclear power plant will employ persons in managerial and supervisory positions who will have to have radiological and nuclear background and persons in technical positions who will require a working knowledge of various aspects of radiation.

F. Conclusion

Because the nuclear power industry in Missouri remains undeveloped and only one nuclear power plant is planned for operation in the next five years, career opportunities in radiation protection will be minimal at least to 1982. The state regulatory program requires additional personnel to handle its present workload and will require up to 20 more professional persons if its responsibilities are expanded to include monitoring the nuclear power plant, radioactive waste disposal, and the transport of radioactive materials. So far, however, state budgetary constraints have prohibited staffing increases. These constraints will have to be relaxed if the state is to be capable of providing effective surveillance of the nuclear power industry.

VI. SOLID WASTE

A. Introduction

Missouri has 92 permitted landfills in operation throughout the state. About 77 of these serve communities with populations of 10,000 or fewer persons, and about 15 serve the metropolitan areas of St. Louis, Kansas City, Springfield, Joplin, St. Joseph, and Columbia. Approximately 82 percent of the state's population are served by approved land disposal sites. The state also has 20 permitted demolition landfills, two permitted hazardous waste disposal sites, six transfer stations, and 116 open dumps.

The Missouri Department of Natural Resources (MDNR), Division of Environmental Quality, Solid Waste Management Program (SWMP) administers the regulatory program for solid waste management in Missouri. The three major functions of the SWMP are permitting disposal areas and enforcing rules and regulations pertaining to them, solid waste planning, and hazardous waste assessment and planning.

In Fiscal Year 1976, the permit process was continued, and open dumps were closed as permitted sites became available. Fifty-eight permits were issued in Fiscal Year 1976, and 146 open dumps were closed. A problem faced by the SWMP is that enforcement actions are often delayed because the Office of the Attorney General does not have sufficient staff allocated to handle all cases referred by the SWMP for legal action.

The Missouri Solid Waste Management Law of 1975 requires that all cities with populations of over 500 persons, as well as Clay, Jackson,

and St. Louis Counties and all cities in these three counties submit a Solid Waste Management Plan to the MDNR. The SWMP staff reviews the plans and issues reports of approval or denial. To date, not all jurisdictions have approved plans. The SWMP staff also provides technical assistance, as necessary, to the cities and counties in the development and implementation of their solid waste management plans.

The 1975 solid waste management law gives the cities and counties increased flexibility in their planning. The law allows jurisdictions to use the solid waste management system and method of financing that they consider best to meet their needs. A drawback of the law, however, is that cities no longer are required to provide universal collection of solid waste. As a consequence, solid waste is more likely than it was previously to be taken to an unauthorized dump. A solid waste collection cost study was conducted in 1976 which shows that substantial cost savings are achieved when a well-managed mandatory system is used in preference to a voluntary system. The results of the study will be used by the SWMP to help convince municipalities of the efficacy of mandatory collection.

The SWMP staff is available to provide technical assistance to cities for resource recovery and recommends that cities of 50,000 or more persons and metropolitan areas consider resource recovery as an alternative to landfilling. To date, however, no municipal resource recovery facilities are in operation.

The SWMP is in the process of conducting a hazardous waste survey and cooperates with industry by providing technical assistance in the disposal of hazardous waste. The staff also assisted in setting up a solid waste exchange that is administered by the St. Louis Regional

Commerce and Growth Association. The Waste Exchange, which employs one coordinator full-time, serves as a clearinghouse for the sale and purchasing of industrial wastes. This project is the first of its kind in the country.

In Fiscal Year 1977 the SWMP will work to improve municipal solid waste management systems through the use of the collection cost study data and model ordinances, plans, and contracts. Technical assistance will be offered to the cities to aid them in developing approvable solid waste management plans. Technical assistance also will be provided to local governments that wish to study the feasibility of resource recovery. In addition, the results of the statewide hazardous waste survey will be analyzed and published in 1977, and an ad hoc committee representing environmental, industrial and agricultural interests will analyze the need for new hazardous waste legislation, and, if necessary, prepare appropriate draft legislation. Finally, the SWMP will work closely with private industry to develop at least one additional hazardous waste disposal facility. It is anticipated that the facility will be located near the St. Louis metropolitan area which now lacks a facility of this type.

B. Workforce Profile

Information for the workforce profile was obtained through on-site and telephone interviews with personnel in the SWMP and in the solid waste programs in the municipalities. Valuable assistance was provided by Robert M. Robinson, Director, and Joseph W. Schilli, Environmental Engineer, SWMP.

Activities of the SWMP are conducted through the central headquarters which are located in Jefferson City and six regional offices located in St. Louis, Springfield, Jefferson City, Kansas City, Poplar Bluff and Macon. The SWMP in the central office is divided into three sections: Solid Waste Planning Section, Hazardous Waste Project, and Solid Waste Technical Services and Enforcement Section. The central office staff includes seven professional and technical personnel and the regional offices contributed approximately three person-years of effort to the program in 1976. The current staffing level, by position, is depicted in the table below.

TABLE IX

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Solid Waste Management Program
Current (1976) Staffing Level

Position	1976
Engineer	4
Sanitarian	1
Scientist	1
Other	4
TOTAL	10

All the engineers are degreed and hold the position of environmental engineer. The sanitarian is an environmental sanitarian, and the scientist holds the position of environmental chemist. The "Other" category includes the program director who is also an engineer and the three person-years of effort of the regional offices. Personnel in the regional offices who contribute time to this program may be engineers or scientists. Because the solid waste control

responsibilities in the regional offices may be assigned to several staff members to conduct on a part-time basis, the precise number of personnel involved in the program could not be determined. The primary activity of the regional office staff with regard to the SWMP is inspection of disposal sites. The Laboratory Services Division, Division of Environmental Quality, MDNR provided less than one person-year of laboratory support to the SWMP in 1976.

Private sector and municipal workforce estimates are based on the best professional judgement of sources at the SWMP and in the municipalities. Staffing levels for disposal operations were estimated in accordance with the following assumptions and computations: The cities of 10,000 or fewer persons staff their disposal sites with an average of 2.5 persons, and there are about 77 permitted sanitary landfills in these smaller towns. Thus, about 193 persons are employed at the rural landfills. Further, an average of 5.5 persons are employed at the landfills in the six metropolitan areas of St. Louis, Kansas City, Springfield, Joplin, St. Joseph, and Columbia, and there are approximately 15 permitted landfills in these areas. This yields a total of about 83 employees at the landfills in the metropolitan areas, and a total of about 276 persons working at sanitary landfills throughout the state.

In addition, the six transfer stations in the state are staffed by a total of about 12 persons, and the two hazardous materials sites are staffed by about four persons. In total, then, there may be about 300 people working in solid waste disposal in the state. Sources in the field estimate that at the landfills, approximately 65 persons work as

heavy equipment operators and the rest work as supervisors, fee collectors, weighmasters, mechanics, and laborers.

Because many communities have not instituted mandatory collection systems, specific data concerning the numbers of persons employed in solid waste collection is difficult to obtain. However, field research suggests that there may be a collection workforce of about 2,000 persons in Missouri. This workforce is somewhat small with reference to the state's population due to the voluntary nature of collection for many cities. In total, then, there maybe more than 2,300 persons employed in solid waste regulation, disposal, and collection in the public and private sectors in Missouri.

C. Workforce Projections

Workforce projection information, again, was provided by sources in the SWMP and various municipalities. It should be noted that these projections represent the best professional judgement of program personnel.

Because of more stringent enforcement of regulations, increased technical assistance, and growing attention to the management of hazardous wastes, the SWMP officials would like to increase the staff by between ten and twenty-five persons over the next three years, with no further growth thereafter to 1982. Most of the additional positions would be devoted to managing hazardous wastes and resource recovery, and the remaining would be used for planning and technical services. Engineers and sanitarians would be hired for such positions. Whether or not this desired staffing growth is realized will depend upon the

availability of increased state and federal funds. Increased staffing for the hazardous waste and resource recovery programs will depend, in particular, on the amount of funding forthcoming from the federal Resource Conservation and Recovery Act.

The rate of turnover for the professional and technical staff of the SWMP averages about 10 percent per annum. Turnover results principally from the availability of higher paying jobs in the private sector and the federal government. The Laboratory Services Program anticipates a growth of between two and five additional chemists to provide support to the hazardous waste management program.

No specific workforce projections could be obtained for the workforce in disposal. Sources in the field anticipate, however, that the workforce in disposal may increase over the next five years as unlicensed dumps are closed and replaced with sanitary landfills. The workforce in collection also may be expected to increase, albeit slowly, as more municipalities implement mandatory collection systems and as population and the volume of solid waste generated grows. Limiting the rate of increase in collection is the introduction of capital intensive collection technology.

At the present time no municipal resource recovery facilities are in operation in Missouri. St. Louis City and Union Electric Company were operating an energy recovery demonstration project supported by EPA, but this system is no longer functional. Several agencies in the St. Louis area are investigating the feasibility of assuming responsibility for the facility, and a decision should be reached in 1977. The Kansas City metropolitan area is conducting a feasibility study of various

resource recovery methods and will develop several proposals by early 1978. Springfield recently conducted a resource recovery feasibility study which resulted in a decision against establishing any such facilities.

D. Training and Certification

The state is not involved in training landfill personnel. Such training was part of the SWMP in the past, but because of a lack of funding, the trainer position was eliminated. There is a need for technical and safety training of landfill personnel, and the SWMP will determine whether jobs will become available there, but even if all desired positions were to be funded, only about 25 new jobs would be created in the next five years.

E. Career Potential

Resource recovery may offer the greatest career potential. Whether or not resource recovery is used extensively in Missouri over the next several years will depend upon cost-effectiveness and political considerations in both the public and private sectors. If resource recovery does begin to develop significantly, career opportunities will become available for professionally and technically trained personnel. Civil engineers, geologists, and hydrogeologists who have specialized in solid waste management and resource recovery could find opportunities in planning and designing resource recovery facilities. Much of the equipment presently used for resource recovery was originally designed for other purposes and therefore is not always adequate for

use in resource recovery operations. Accordingly, highly trained engineers may be needed for design equipment. Mechanics, electricians, laborers, supervisory personnel, and administrators who are knowledgeable in solid waste management and resource recovery also would be in demand. It should be pointed out that were resource recovery to develop, the majority of jobs would likely be for unskilled workers to perform assembly line type operations. These jobs typically offer little opportunity for career advancement.

F. Conclusion

While it is difficult to predict what impact the Resource Conservation and Recovery Act will have on the state of Missouri, officials at the SWMP indicate that if sufficient money is forthcoming from the Act, ten to twenty persons would be hired for hazardous waste management and resource recovery. An optimum staffing increase over the next three years, according to SWMP officials, would be the addition of up to twenty-five professional and technical persons. The extent of future resource recovery activities in the state cannot yet be determined, although the SWMP officially encourages the implementation of resource recovery facilities in the more populous areas of Missouri.

Further, specific workforce projections cannot be made for solid waste collection and disposal. Field research indicates, however, that some growth will occur in both areas. Growth in disposal will occur as a result of open dumps being closed down and replaced with sanitary landfills which require an increased number of attendants. In collection, growth will result from population and consequent solid waste volume

increases and from the anticipated implementation of mandatory collection systems in many municipalities. The changing technology of collection, which is making it more capital intensive, will tend to minimize the growth here.

Currently, no formal training programs exist for personnel at the landfills, and the SWMP does not have the resources either to offer training courses or to provide on-site training at the landfills. If the SWMP cannot obtain necessary funding to provide such training, a substitute might be EPA or technical institution sponsored short courses, either self-instructional or offered at easily accessible locations around the state.

VII. WASTEWATER

A. Introduction

There are approximately 2,760 wastewater treatment facilities in Missouri. An estimated 900 of these are muncipal, 60 major industrial, 500 minor industrial, and 1,300 minor private and domestic. Wastewater treatment plants are classified according to the size of the facility as follows: A) at least 15 million gallons per day; B) 2.5 to 15 million gallons per day; C) 0.5 to 2.5 million gallons per day; D) no more than 0.5 million gallons per day. A mandatory operator certification program was instituted in 1977, which requires that the operator in responsible charge of a wastewater treatment facility be certified at the classification of the facility or at a higher level. This requirement applies to all wastewater systems serving populations greater than 200 or with 25 or more service connections, all municipal wastewater systems, public sewer districts and private sewer companies regulated by the Missouri Public Service Commission, and systems operated by the state or federal government.

The Missouri Department of Natural Resources (MDNR), Division of Environmental Quality, Water Quality Programs (WQP) has regulatory responsibility for the wastewater pollution control program. The major functions administered by the WQP are issuing permits for construction and operation of wastewater treatment works, monitoring and management planning of the water quality of the state, inspecting and monitoring water contaminant sources, investigating complaints from the public, and administering grants to municipalities and political subdivisions for construction of wastewater treatment works.

In October 1974, MDNR received authority from EPA to administer the NPDES permit program. By March 31, 1976, a total of 2,500 NPDES permits had been issued and 569 reissued. These numbers include permits for all major dischargers. In Fiscal Year 1977, the WQP staff will direct substantial efforts to compliance monitoring of permit conditions and to continuing permit issuance to minor dischargers. Permit compliance and enforcement is accomplished through the use of "informal show-cause" orders, "formal show-cause" orders, abatement orders, and court actions, if necessary. According to WQP officials, a major accomplishment in 1976 in NPDES permit compliance follow-up was the development and operation of the "informal show-cause" order. Through this mechanism, permit holders are encouraged to come to the WQP regional offices to negotiate mutually acceptable alternatives to formal legal action. It is reported that up to 80 percent of the non-compliance cases were resolved in this manner.

The WQP staff's activities for the Construction Grants Program include maintaining up-to-date reviews of applicants, O & M Manuals, plans and specifications, change order, and facilities plans. Unless the level of grant funding for Fiscal Year 1977 increases or changes are made in the amendments to PL 92-500, the present program will continue at the Fiscal Year 1976 level.

The MDNR, Division of Environmental Quality, Laboratory Services Program provides monitoring and analytical services to the central and regional offices for determining compliance with NPDES permit specifications. In Fiscal Year 1977, the Laboratory Services Program will

provide technical assistance in developing and implementing a strategy for continuing monitoring of ground water and in developing, implementing, and maintaining a statewide monitoring strategy. Also, Laboratory Services Program personnel will develop and implement a formal quality assurance program to promote the collection and reporting of valid effluent and water quality monitoring data.

The Governor of Missouri has designated three areas as areawide waste treatment management planning areas: five Missouri counties around Kansas City (three adjoining Kansas counties are also included in this area), a four-county area around St. Louis, and a small area around Joplin. The agencies designated to prepare area wide "208" plans are the Mid-American Regional Council (Kansas City), the East-West Gateway Coordinating Council (St. Louis), and the Ozark Gateway Regional Planning Commission (Joplin). The MDNR has entered into a "208" coordination contract with East-West Gateway Coordinating Council and anticipates entering into similar agreements with the other two agencies to provide program assistance, technical assistance, coordination of the areawide "208" planning programs with affected on-going state programs, monitoring and review of area wide "208" planning outputs, and certification of the detailed work plans and the final area wide "208" plans. A major portion of the statewide "208" plans will address agricultural non-point sources.

Field research indicates that several problems exist with regard to wastewater pollution control in Missouri. First, no satisfactory methods have been developed for sludge disposal, and potential pollution problems could result from this. Second, wastewater treatment

equipment is often poorly designed and does not do the job properly. Consequently, operators have to spend time re-designing equipment to meet their needs. Third, construction grants are not meeting funding requirements, and secondary treatment will not be accomplished by the July, 1977 deadline. Fourth, the paperwork involved in the NPDES program and in environmental impact planning is excessive, especially considering available resources. Finally, the federal government fails to appreciate local conditions of operation and, therefore, cannot respond appropriately and adequately to Missouri's problems.

B. Workforce Profile

Information for the workforce profile was obtained through on-site and telephone interviews with professionals in the state wastewater pollution control program. Of particular assistance in the collection and compilation of these data were Mr. Robert Hentges, Director, Mr. James Odendahl, Staff Director, WQP, and Mr. Edward Lightfoot, Regional Office Director, Division of Environmental Quality, MDNR.

The WQP is carried out through its headquarters in Jefferson City and six regional offices which are located in St. Louis, Springfield, Jefferson City, Kansas City, Poplar Bluff, and Macon. At Jefferson City headquarters, the program is divided into five sections: Administrative Support Section, Clerical Staff, Construction Grants Program, NPDES Permits and Enforcement Section, and 208-305b-303e Planning Section. The headquarters WQP technical and professional staff totals 20 persons. The six regional offices contribute about 67 percent of their effort to the WQP. Thus, in 1976, approximately 46 person-years

were devoted to the WQP in the regional offices. Because WQP activities in the regional offices may be assigned to several staff members to carry out on a part-time basis, the precise number of involved personnel could not be ascertained. In the table below, which illustrates the distribution of WQP among existing positions, the efforts of the regional office are included in the "Other" category.

TABLE X

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Water Quality Program
Current (1976) Staffing Level

Position	1976
Engineer	8
Scientist	10
Other	48
TOTAL	66

The engineers hold the position of environmental engineer. All are degreed and many are registered professional engineers. The scientists hold the position of water quality specialist. Most of these persons are degreed biological scientists. The "Other" category includes the WQP director who is an engineer, an administrative assistant, and the personnel from the regional offices. Regional office staffs are composed of engineers and scientists. Also in each regional office is a wastewater works supervisor. This position requires several years of on-the-job experience in wastewater treatment operations, and all the wastewater works supervisors are certified operators. The wastewater works supervisors are responsible for

training operators, conducting plant inspections, and for trouble-shooting at the treatment facilities. As with the waterworks supervisors in the MDNR Water Supply Program, the wastewater works supervisors have proven to be effective in training treatment plant personnel, handling emergencies, and dealing with in-plant problems on a day-to-day basis.

In the Laboratory Services Division, seven professional staff members provide support for the WQP. This staff includes five water quality specialists and two chemists. These persons conduct water quality monitoring, biological analysis, and chemical analysis. Field sources estimate that there are about 150 laboratories engaged in wastewater testing and analysis. About 60 of these laboratories may be privately owned and operated. There may be a total of up to 300 persons working in these laboratories as chemists and laboratory technicians who are engaged in wastewater pollution control activities.

A certification program for wastewater treatment plant operators became mandatory in 1977. Prior to the mandatory program, which is administered by the MDNR, a voluntary program, conducted by the Missouri Operator Certification Board, was in effect. WSP data indicates that as of March, 1977, 710 persons were certified under the voluntary and mandatory programs combined. Since the mandatory certification program has only recently been initiated, many additional non-certified operators currently working in the field may obtain certification over the next several years. The following table illustrates the estimated distribution of certified and non-certified wastewater treatment plant

operators by classification of the treatment plant in which they are employed. These estimates were obtained from WSP officials.

TABLE XI

Current (1976) Certified and Non-certified
Wastewater Treatment System Operators (est.)

Classification	1976
A	100
B	300
C	500
D	1,100
TOTAL	2,000

Sources in the field further estimate that, in addition to the approximately 2,000 wastewater treatment facility operators, there may be 1,000 persons employed by these facilities in positions such as maintenance, labor and administration.

In total, then, there are approximately 3,370 persons in the state working in the wastewater pollution control field in the public and private sectors.

C. Workforce Projections

Workforce projections are based on the best professional judgement of personnel in the WQP. Information was obtained through on-site and telephone interviews.

Growth is expected in the state WQP in the central office staff and in the regional offices. Table XII illustrates projected growth, by position, to 1982 for the WQP.

TABLE XII

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Water Quality Program
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	8	8	8	8	8	8	n/a	0
Scientist	10	10	16	16	16	16	n/a	12%
Other	48	58	58	58	58	61	n/a	5%
TOTAL	66	76	82	82	82	85		5%

A growth of about ten positions is expected for the regional offices in 1977. This growth is indicated in the "Other" category. In the central office, six water quality specialists may be added to the staff in 1978. This growth will be necessary to deal effectively with "208" area wide planning and the growing workload associated with NPDES monitoring. Water specialists with expertise in planning and computer modeling will be sought for many of the WQP positions. It is anticipated that in 1981 three more professional persons will be added to the central office staff. Thus, the aggregate average per annum rate of growth for the WQP may be about 5 percent.

While specific turnover rates could not be obtained from WQP officials, sources in the central and regional offices indicate that professional and technical turnover is less than 10 percent per annum. Turnover results from retirement and from migration of employees to private sector and federal government jobs which frequently offer higher salaries.

According to field research, little growth is likely to occur in laboratory positions in either the public or private sector. Any additional required laboratory testing is expected to be carried out by the operator in charge of a treatment facility or by an assistant.

WQP sources indicate that the institution of the mandatory certification program combined with plant construction and more stringent enforcement of existing regulations will result in the need for more and better trained certified treatment plant operators over the next five years. In planning the mandatory certification program, officials developed estimates of the projected number of certified treatment plant operators likely to become certified by 1980 for this study. These projections are shown in Table XIII below:

TABLE XIII

Wastewater Treatment Plant Operators Workforce Projections to 1981 (est.)

Classification	1976	1977	1980	%/annum growth (average)
A	100	129	162	16%
B	300	408	476	15%
C	500	639	815	16%
D	1,100	1,391	1,759	15%
TOTAL	2,000	2,567	3,212	15%

The projected per annum growth rate for the next four years for certified treatment plant operators, in aggregate, is 15 percent. At full-plant staffing a total of 3,600 operators will be needed but may not be obtained until after 1980. Historically, aggregate turnover for treatment plant operators has been 38 percent, with turnover being less for operators at the larger systems and greater for operators

employed at the smaller systems. With the advent of a mandatory certification program, it is anticipated that an accompanying career ladder will develop and that the rate of turnover will concomitantly decline, perhaps to an average of 25 percent per annum over the next several years. It should be noted, however, that unless municipalities can afford to reward an upgrade in certification with a salary increase, the turnover rate is apt to remain at the present high level.

The construction of new plants and plant modifications will lead to workforce growth not only for certified operators but also for other wastewater treatment personnel in such areas as administration, maintenance, and general labor. However, specific workforce projections for these areas cannot be made from the available information. Increasing automation in treatment plant operations may tend to have a limiting influence upon the amount of new employment that will accompany plant construction and modification.

In summary, the WQP may experience a growth of 19 professional staff members over the next five years, an average growth rate of 5 percent per annum. Increased staff will be used for conducting the "208" area wide planning program and for NPDES monitoring. Currently the state program is working at capacity and cannot expand its activities without an increase in resources. Little growth is expected in public or private laboratories in the state in connection with wastewater testing and analysis. Because of the mandatory certification program, plant construction, and stringent enforcement of regulations, a growth of 13 percent per annum is projected for certified treatment plant operators over the next four years. This is equivalent to an

increase of about 1,212 operators in total, or about 300 operators per year. Although specific workforce profiles and projections cannot be determined for treatment plant positions other than certified operators, WQP officials indicated that growth will occur in administrative, labor and maintenance positions.

D. Training and Certification

Informal on-the-job training is provided for members of the WQP staff. In addition, new employees participate in an orientation program which consists of two days of training per week for four months. The MDNR does not sponsor formal wastewater training programs for treatment plant personnel, although the wastewater works supervisors in the regional offices are responsible for offering on-the-job training in plant operations and maintenance. In Fiscal Year 1977, the wastewater supervisors are expected to provide 192 days of training and to reach about 2,000 operators. It is further anticipated that the wastewater supervisors will provide technical assistance to 70 to 75 plants with especially severe problems.

The Water and Wastewater Technical School in Neosha, Missouri, cooperates with MDNR to offer formal training courses to treatment plant personnel. In Fiscal Year 1977, a 12-week intensive wastewater operator training course will be held in eight locations around the state. The courses will be taught by instructors from the Water and Wastewater Technical School under contract with the MDNR. Classes will be held one day per week for eight hours per day. Approximately 300 persons will be trained through these courses, and an estimated

250 persons are expected to obtain certification upon completion of the course.

An associate's degree in water and wastewater treatment plant operations is offered through a joint program of the Water and Wastewater Technical School and Crowder College, a two-year community college. Between 100 and 125 students graduate from this program annually. About 39 percent obtain jobs as wastewater plant operators and superintendents and about 13 percent are employed simultaneously in water and wastewater operations. The remaining 48 percent become laboratory technicians, water plant operators and superintendents, and regulatory personnel. The University of Missouri at Rolla has an M.S. degree program in environmental and planning engineering which offers courses in wastewater treatment and water resources engineering.

According to field research, training problems with regard to wastewater treatment plant personnel are similar to those of water supply treatment plant employees. Many of the operators who run the smaller rural utilities have insufficient background and training for their jobs, and many of these utilities cannot afford the expense of travel and tuition to training courses. The on-the-job training provided by the wastewater works supervisors and the geographic distribution of the courses held by the Water and Wastewater Technical School should reach many of the rural operators and help to mitigate this problem. Perhaps a further means of improving operator expertise would be the development of home study courses to supplement the training provided by the wastewater works supervisors and the Water

and Wastewater Technical School. Finally, there is a need for more extensive and in-depth courses at the intermediate and advanced levels.

E. Career Potential

The state WQP may grow by about 19 positions over the next five years, thus offering career opportunities for some persons with expertise in water quality planning and computer modeling. Little career potential appears likely for laboratory personnel, since any additional testing probably can be handled by existing laboratory personnel and by treatment plant operators.

Because of the newly instituted mandatory certification requirement, treatment plant construction, and more stringent enforcement of regulations, the area of greatest career potential is in plant operations, maintenance, labor, and administration. The largest amount of growth is projected to be for certified operators whose numbers may increase by over 1,000 operators in the next four years or at a 15 percent average per annum rate.

It should be emphasized that the average annual turnover rate for treatment plant operators across the state is currently 38 percent. This indicates that openings are continually available for new operators, but it also suggests that undesirable working conditions exist at many plants. Turnover tends to be highest in the smaller utilities which frequently offer lower salaries and fewer opportunities for advancement than the utilities which are located in wealthier urban areas.

F. Conclusion

This analysis suggests that the area of greatest workforce growth will be for wastewater treatment plant operators. Growth may also occur in maintenance, labor, and administration. This is the result of the mandatory operator certification requirement, new plant construction and plant modification, and more stringent enforcement of regulations. The state WQP anticipates expanding its staff by about 19 persons over the next five years to carry out "208" area wide planning and NPDES activities. The program is currently operating at capacity and requires additional personnel if increased responsibilities are to be discharged effectively.

Missouri faces serious difficulties in ensuring that properly trained personnel operate wastewater treatment facilities, particularly in the rural areas of the state. Many of the smaller communities cannot afford to send their operators to training sessions and, further, operators with no prior experience or training are continually hired to replace the high level of turnover. The MDNR is attempting to improve operator training through the use of the wastewater supervisor and the geographical dispersion of instructional offerings. In addition, WQP officials anticipate that the mandatory certification program will contribute to a reduction in turnover by providing operators with a career ladder. However, unless utilities can afford to reward advancement in operator classification with a salary increase, incentive to upgrade will remain low and turnover may not improve.

VIII. ENERGY

A. Introduction

Although Missouri mines coal and has hydroelectric plants on Ozark lakes, about 90 percent of the state's energy must be imported. The only short-run energy supplement to the state is that which can be obtained through conservation measures, although coal research is underway to determine the potential utilization of more Missouri coal either through direct use or coal gasification.

The Missouri State Government has one principal energy agency, the Missouri Energy Agency (MEA). This agency was created by transferring the Fuel Allocation Office in the Public Service Commission to the Department of Natural Resources through an interdepartmental agreement in January, 1975. The functions of the MEA are as follows:

1) To assist the people and economy of Missouri in meeting energy needs by developing or recommending the development of laws, programs, procedures, and policies of state and local governments that will ensure efficient use of energy resources;

2) To develop a capability to manage effectively an energy shortage in the state;

3) To promote methods of reducing consumption of scarce energy resources for public and private sector activities;

4) To coordinate research and development activities designed to conserve energy and increase supply;

5) To serve as a source of information and assistance in all energy-related matters for the state.

Included in the MEA's major programs are the development of a state energy plan, an energy management network to provide technical assistance to small businesses, industry, and local government, an energy education project, data collection and projections, and contingency planning. The state energy plan is designed to promote efficient use of energy in the public and private sectors. A voluntary network of mechanical engineers, faculty, and students at the universities and mechanical engineers in the private sector provide technical assistance to small businesses, industry, and local government in energy management. The energy education project is a joint effort between MEA and the University of Missouri Cooperative Extension Service, through which publications and slide-tape presentations are created for distribution to various segments of the community.

B. Workforce Profile

Data for the workforce profile were gathered through on-site and telephone interviews with professionals in the energy field. Particularly appreciated is the assistance of Ms. Judie Cartee, Missouri Energy Agency.

The staff of the MEA is composed of six professional persons. All are degreed and have a variety of backgrounds including education, geology, political science, and sociology.

Data on the size of the private sector energy-related workforce are not available at the present time. Field research indicates that in the private sector most energy-related activities are conducted in the area of energy conservation. Many companies have hired or are

planning to hire an energy coordinator to perform such functions as supervising boiler operations, assessing long-term fuel supply, developing an energy conservation plan, and controlling pollution. The energy coordinator often becomes a member of the company's energy procurement operation and probably has a small staff, if any.

C. Workforce Projections

Workforce projections are based upon the best professional judgement of sources in the field. The MEA requires an increase in its staff to continue to carry out and to expand its program. Sources at MEA note that a fully staffed energy agency for the state would include approximately 19 professional persons. The MEA hopes to obtain an energy engineer and two other professionals in the coming year and about two professionals per year thereafter to 1982. However, whether these staffing increases will be realized is primarily dependent on the level of federal funding.

The area of greatest demand in the private sector at the present time appears to be for energy coordinators for industry. Field research suggests that additional jobs may be generated in industry to coordinate energy conservation programs and to keep top management informed of energy-related legislation and regulations. Growth may also occur among consulting engineers to assist private industry in solving energy problems, and scientists and engineers may become involved in research of alternative energy sources. Professionals in the field were not able to provide specific estimates of expected workforce growth in these areas.

D. Training and Certification

The University of Missouri and other state colleges and universities provide training for engineers, scientists, and architects. The MEA also provides public information on energy conservation. Field research suggests that there are no comprehensive education programs in the state in energy management.

E. Career Potential

Career opportunities may develop over the next five years for degreed and highly trained engineers, scientists, and architects in energy research, product design and development, building design, and energy management. Few career opportunities appear to be emerging for non-degreed vocational/technical personnel.

F. Conclusion

Career opportunities in the public sector in energy planning and conservation appear to be quite limited. However, Missouri's energy dependency makes it imperative that new sources be developed. Consequently, there may be a growing demand for highly trained scientists, engineers, and architects. Specific projections for this workforce cannot be made at the present time.

Selected Post Secondary Institutions
With Formal Environmental Energy Programs

Most of the higher education institutions in Missouri do not appear to be actively engaged in training students to work in pollution control and abatement occupations. Some institutions do, however, offer programs in this field. Among these are Washington University, Central Missouri State University, Meramec Community College, University of Missouri, Crowder College and the Water and Wastewater Technical School.

Washington University provides a B.S., M.S., and Ph.D. program in civil engineering. Available in these curricula are various environmental engineering courses. Central Missouri State University offers an A.S. degree in Water and Wastewater Technology and also offers a small selection of environmental biology courses. A two-year Environmental Technology program is available through Meramec Community College. This program trains students to become water and wastewater treatment plant operators, sanitarian aides, public health engineering aides, stream sanitarian technicians, and technical sales and service representatives.

The University of Missouri at Rolla offers engineering curricula with environmental emphases. Crowder College and the Water and Wastewater Technical School provide a cooperative program through which students earn an associate's degree in water and wastewater treatment plant operations. Contained in the following section is additional information about the programs of the University of Missouri and Crowder College-Water and Wastewater Technical School. It is designed to provide an example of curricula available through a Missouri senior institution and a community college/vocational institute.

SENIOR INSTITUTIONS

University of Missouri
Rolla, Missouri

Programs: M.S. Environmental & Planning Engineering
M.S. Environmental & Sanitary Engineering

Hours required for major: semester: 30 with thesis
33 without thesis

Program Inception: 1969
Staff Size: 5 (1 professor, 2 associate professors, 2 associate professors)
Enrollment (1976): 3 (Environmental & Planning)
2 (Environmental & Sanitary)
Placement: 4

Courses (Selected Listing)

Building Planning and Design
Urban and Regional Planning and Design
Traffic and Transportation
Urbanization and Environmental Seminar
Water, Resources and Waste Management
Solid Waste Management
Solid Waste Laboratory
Air Pollution Abatement I and II
Water Resources and Engineering
Water Treatment
Wastewater Treatment I and II

COMMUNITY COLLEGES/TECHNICAL INSTITUTIONS

Water and Wastewater Techincal Schools (WWTS)
Neosho, Missouri
and
Crowder College
Neosho, Missouri

Program: Environmental Health (Certificate, if complete WWTS only)
(A.A.S. joint program)
Options: Bio-Chemical Technician
Plant Operation and Maintenance
Plant Supervision and Management
Pre-Baccalaurette Degree

Hours required for major: 30 from WWTS
31-33 from Crowder College
Program Inception: 1974 (joint program)
1959 (WWTS only)
Staff Size: WWTS-14 (Ph.D., M.S., B.S. and nondegreed. All are Class A licensed operators in water and/or wastewater and have an average of 15 years of field experience.)
Enrollment: WWTS-110
Crowder College (joint program)-20
Graduates (1976): WWTS-125
Crowder College (joint program)-8
Placement: WWTS only-93% average per year
Crowder College (joint program)- 1976 -8 students

Courses (Selected Listing)

1. Water and Wastewater Technical School
Chemistry of the Environment
Chemistry Laboratory
Metric System for Water and Wastewater
Communications Skills
Safety in Water and Wastewater
General Microbiology
Applied Physics
Field Visits to Water, Wastewater and Solid Waste Sites
Environmental Microbiology
Electricity for Water and Wastewater
Chlorination and Disinfection Workshop
Instrumentation for Water and Wastewater

Hydraulics for Operators
Hydrology
Pumps for Water and Wastewater Systems
Water Distribution, Design and O&M
Water Utility Management
Industrial Water Treatment
Saline Water Treatment
Wastewater Collection Design, O&M
Advanced Waste Treatment
Ultimate Solids Disposal, Land Application
Activated Sludge Workshop

2. Crowder College
   Zoology
   Physics
   Algebra
   Chemistry
   Political Science
   History
   Electricity and Electronics
   Introduction to Welding
   Principals of Fluid Power
   Machine Tool Processes
   Personnel Management
   Technical Report Writing
   Accounting
   Economics

State Legislation

MISSOURI AIR

TITLE:

Air Conservation Law
Missouri Statutes 203.010

PURPOSE:

To maintain purity of air resources of the state, to protect the health and general welfare of the state, and to create an air conservation commission.

DEFINITIONS:

1. Air cleaning device
2. Air contaminant
3. Air contaminant source
4. Air pollution
5. Ambient air
6. Area of the state
7. Commission
8. Department
9. Division
10. Emission
11. Emission control regulations
12. Executive secretary
13. Person

ADMINISTERING AUTHORITY:

Department of Public Health and Welfare
Air Conservation Commission

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To establish air contaminant limits;
To require information of air polluters;
To approve air pollution control devices;
To enter and inspect property in enforcement of the act;
To develop a comprehensive air pollution control plan;
To conduct air pollution studies and investigations;
To act as the state lead agency in air pollution matters;
To grant variances;
To declare air pollution emergencies.

PROHIBITED ACTS:

To construct air contaminant source without permit;
To violate air contaminant standards;
To violate the terms of any permit;
To violate other act provisions or regulations.

PENALTIES:

Fines of up to $5,000 per day.

MISSOURI PESTICIDES

TITLE:

Pesticide Act of 1974
Missouri Statutes

PURPOSE:

To provide for the control of pesticides through a program of applicator certification.

DEFINITIONS:

1. Animal
2. Applicator or operator
3. Beneficial insect
4. Certified applicator
5. Certified commercial applicator
6. Certified private operator
7. Defoliant
8. Desiccant
9. Device
10. Environment
11. Equipment
12. Fungus
13. Insect
14. Land
15. Nematode
16. Permit
17. Person
18. Pest
19. Pesticide
20. Pesticide dealer
21. Plant regulator
22. Private applicator
23. Public operator
24. Restricted use pesticide sale
25. Snails or slugs
26. Under the direct supervision of
27. Unreasonable adverse effect on environment
28. Weed
29. Wildlife

ADMINISTERING AUTHORITY:

Department of Agriculture

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To classify pesticides and restrict their usage;
To regulate the storage and disposal of pesticides;
To establish applicator certification standards;
To categorize commercial applicators;
To certify private and commercial applicators;
To enter and inspect property in enforcement of the act;
To license pesticide dealers;
To generally enforce the act.

CERTIFICATION OR LICENSING:

Commercial and private applicators must be certified to use restricted use pesticides; examination required; categories established include structural pest, ornamental or agricultural, right-of-way, and others by regulation.

PROHIBITED ACTS:

To apply pesticides commercially to another's property without proper certification;
To use restricted use pesticides without proper certification;
To sell pesticides without proper license;
To violate other act provisions.

EXEMPTIONS:

Veterinarians, physicians, and research personnel.

PENALTIES:

Violation constitutes a misdemeanor.

MISSOURI RADIATION

TITLE:

Radiation Control Law
Missouri Statutes 192.400

PURPOSE:

To establish a program of radiation control and protection and to create a committee on radiation control.

DEFINITIONS:

1. Committee on radiation control
2. Radiation
3. Radiation machine
4. Unnecessary radiation

ADMINISTERING AUTHORITY:

Division of Health
Committee on Radiation Control

AUTHORIZATIONS:

To develop a program for determination and elimination of radiation hazards;
To cooperate with other state and federal agencies;
To conduct studies relating to radiation hazards;
To review plans for radiation sources;
To issue regulations pursuant to the act;
To require registration of radiation sources.

PROHIBITED ACTS:

To fail to shield sources of radiation;
To produce, use or dispose of radioactive materials or radiation machines without registration;
To violate any regulations or orders issued under the act.

EXEMPTIONS:

Medical uses for the purpose of diagnosis, therapy, or medical research.

PENALTIES:

Violation constitutes a misdemeanor.

NRC AGREEMENT STATE: No

MISSOURI SOLID WASTE

TITLE:

Junkyards Law
Missouri Statutes 226.650

PURPOSE:

To prohibit the establishment, operation, and maintenance of junkyards in areas near interstate and primary highways of the state.

DEFINITIONS:

1. Automobile graveyard
2. Interstate system
3. Junk
4. Junkyard
5. Primary system

ADMINISTERING AUTHORITY:

State Highway Commission

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To issue licenses for junkyards near highways;
To supervise junkyard operation and enforce the act.

PROHIBITED ACTS:

To establish or operate a junkyard without required permit;
To construct junkyard screening as required;
To violate other regulations issued under the act.

PENALTIES:

Fines of up to $100.

MISSOURI SOLID WASTE

TITLE:

Solid Waste Management Law
Missouri Statutes 260.200

PURPOSE:

To provide for solid waste management and the control of solid waste disposal.

DEFINITIONS:

1. City
2. Department
3. Director
4. Person
5. Solid waste
6. Solid waste disposal area
7. Solid waste management system
8. Solid waste processing facility

ADMINISTERING AUTHORITY:

Department of Natural Resources
Local Governmental Units

AUTHORIZATIONS:

To issue permits to solid waste disposal systems and facilities;
To provide for the local collection and disposal of solid waste;
To approve local solid waste management plans;
To issue regulations pursuant to the act;
To develop a statewide solid waste management plan.

PROHIBITED ACTS:

To dispose of solid waste other than at a proper facility;
To construct or alter solid waste facility without permit;
To violate other act provisions or regulations.

PENALTIES:

Fines of up to $100 per day.

MISSOURI WASTE WATER

TITLE:

Clean Water Law
Missouri Statutes

PURPOSE:

To conserve the waters of the state and to protect, maintain, and improve the quality thereof.

DEFINITIONS:

1. Discharge
2. Effluent control regulations
3. Person
4. Point source
5. Pollution
6. Pretreatment regulations
7. Sewer system
8. Treatment facilities
9. Water contaminant
10. Water contaminant source
11. Water quality standards
12. Waters of the state
13. Significant portion of his income
14. Permit holders or applicants for a permit
15. Income

ADMINISTERING AUTHORITY:

Clean Water Commission

AUTHORIZATIONS:

To issue regulations and enforce the act;
To develop comprehensive plans for water pollution control and abatement;
To conduct studies and investigations relating to water pollution;
To establish water quality standards;
To approve and issue permits for construction of water treatment facilities;

AUTHORIZATIONS (Cont'd):

To establish effluent limitation and pretreatment standards;
To act as the state lead agency in water pollution matters;
To develop and operate laboratory facilities;
To grant variances under the act.

PROHIBITED ACTS:

To cause or allow pollution of waters of the state;
To violate the conditions of any permit;
To discharge radiological, chemical, or biological warfare agents into waters of the state;
To construct or operate any point source without required permit;
To violate any water quality standards or regulations issued under the act.

PENALTIES:

General violations - fines of up to $10,000 per day;
Willful violations - fines of from $2,500 to $25,000 per day or one year imprisonment;
Subsequent violations - fines of up to $50,000 per day or two years imprisonment.

END

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